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REVISION OF THE SCALEWORM GENERA *ARCTONOE* CHAMBERLIN AND *GASTROLEPIDIA* SCHMARDA (POLYCHAETA: POLYNOIDAE) WITH THE ERECTION OF A NEW SUBFAMILY ARCTONOINAE.

J. RUSSELL HANLEY
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin NT 0801, Australia.

ABSTRACT

A new subfamily Arctonoinae is erected for several genera of polynoid scaleworms. Descriptions of *Arctonoe vittata* (Grube), *A. fragilis* (Baird), *A. pulchra* (Johnson) and *Gastrolepidia clavigera* Schmarda are provided. *Harmothoe tuberculata* Treadwell, 1906 is referred to *Bathynoe* Dilevsen. A new genus and species *Asterophilia carlae* from Fiji and Indonesian waters is described.

KEYWORDS: Polychaeta, Polynoidae, *Arctonoe*, *Gastrolepidia*, new subfamily, new genus and species, generic revision, commensals, Indo-West Pacific.

INTRODUCTION

Pettibone (1953:8) divided the genera of polynoid scaleworms into three groups, based on the manner in which the lateral antennae were attached to the prostomium. These three groupings were: Lepidonotoid, where the ceratophores of the lateral antennae are attached directly to the anterior ends of the prostomium, appearing as outgrowths of the prostomium and represented by the subfamily Lepidonotinae Willey, 1902; Harmothoid, where the distinct ceratophores of the lateral antennae are attached to the ventral surface of the prostomium, represented by the subfamily Harmothoinae Horst, 1917 (=Polynoinae Muir, 1982); and a third group, Aretonoid, in which the ceratophores derive terminally or slightly ventrally from the prostomium and converge in the midline on the underside of the prostomium, represented by the genus *Arctonoe*.

Since then several other authors, notably Day (1967:41), and Usehakov (1977:33, 1982:60) have indicated that they view the aretonoid type of prostomium as a distinct one and that several genera possess its features. However, although many new subfamilies are now recognised in the family Polynoidae (Muir 1982; Pettibone 1976, 1983a, 1984, 1985a, 1985b; Usehakov 1977), there has been no attempt to assess the subfamily status of those genera which exhibit the aretonoid type of lateral antennae insertion, now widely described as subterminal, Day (1967) or terminoventral, Pettibone (1953).

The two genera *Arctonoe* Chamberlin, 1920 and *Gastrolepidia* Schmarda, 1861 have been considered by some authors to be closely related (Usehakov 1977; Pettibone pers. comm.). Both genera are revised here as part of a wider study of the systematics of the group of seven genera of polynoid scaleworms listed by Fauchald (1977) as possessing subterminal (terminoventral) insertion of the lateral antennae upon the distal end of the prostomium.

In this paper the similarities between *Arctonoe* and *Gastrolepidia* are confirmed and are considered sufficiently distinct from other polynoid scaleworms to warrant the erection of a new subfamily.

Several other genera are also referred to the new subfamily, including a new genus and species commensal on starfishes.

I wish to thank Dr Marian Pettibone for freely providing me with a great deal of unpublished information, including her diagnosis of Aretonoinae. I had independently arrived at the same conclusion regarding the need for a new subfamily for *Arctonoe* and *Gastrolepidia* but I found the information provided by Dr Pettibone especially useful in the construction of a subfamily description and the selection of genera to be placed within it. In deference to the important contribution she has made to this work, I have retained her

polynoid group name to be used for the subfamily.

The genus *Arctonoe* was originally established by Chamberlin, 1920 for his new species, *Arctonoe lia*. The type material bears the name *Schizonoe lia* which appears to have been a catalogue or manuscript name used by Chamberlin, and subsequently was changed by him to *Arctonoe lia* at the time of publication. The genus was monotypic until Hartman (1938:115-116) emended the genus *Arctonoe* and included four known species: *Polynoe vittata* Grube, 1855, *Polynoe pulchra* Johnson, 1897, *Lepidonotus fragilis* Baird, 1863, and *Harmothoe tuberculata* Treadwell, 1906.

Hartman considered that Chamberlin's *A.lia* was synonymous with the earlier published description of *Polynoe vittata*, and therefore the type species of the genus is now widely held to be *A. vittata*.

Gastrolepidia clavigera Schmarda, 1861 is monotypic. One other species *G. amblyphyllus* Grube, 1876, was synonymised with *G. clavigera* by Hartman (1959:70).

The following abbreviations are used in this paper to indicate the present location of material examined or discussed: AHF Allan Hancock Foundation, University of Southern California, Los Angeles; AM Australian Museum, Sydney; MCZ Museum of Comparative Zoology, Harvard University, Cambridge Massachusetts; MNHN Museum National d'Histoire Naturelle, Paris; NMW Naturhistorisches Museum, Wien; NRS Naturhistoriska Riksmuseet, Stockholm; NTM Northern Territory Museum, Darwin; USNM National Museum of Natural History, Smithsonian Institution, Washington D.C.; VMM Victoria Memorial Museum, Ottawa; ZMA Zoologische Museum, Amsterdam; ZMH Zoologische Museum, Hamburg.

SYSTEMATICS

Family Polynoidae Malmgren, 1867
Subfamily Arctonoinae subfam. nov.

Diagnosis. Body usually elongated, with numerous segments. Elytra usually numerous pairs on segments 2, 4, 5, 7, then variable in arrangement. Prostomium bilobed, with three antennae, paired palps, and two pairs of eyes, on the posterior half of the prostomium. Anterior lobes of prostomium rounded, with or without small peaks; median antenna with large ceratophore in anterior notch; lateral antennae with distinct ceratophores inserted terminoventrally or ventrally, converging midventrally. Tentacular (first) segment not visible dorsally, tentaculophores lateral to prostomium, with acicula, achaetous, with two pairs of dorsal and ventral tentacular cirri resembling antennae. Second or buccal segment with or without nuchal lobe, with first pair of elytra, subbiramous parapodia, with ventral buccal cirri longer than following ventral cirri. Parapodia subbiramous, notopodia small, subconical, sometimes vestigial, on anterodorsal side of larger neuropodia, with notoacicula, notosetae usually few in number or absent; neuropodia deeply notched dorsally and ventrally, with rounded to pointed presetal lobes and shorter, rounded, postsetal lobes. Neurosetae relatively few, variable. Dorsal cirri on non-elytragerous segments, with cylindrical cirrophores posterodorsal to notopodia and distal styles; dorsal tubercles usually inconspicuous. Pygidium usually with pair of anal cirri. Pharynx usually with 9-11 pairs of papillae and 2 pairs of jaws. Often commensal.

Remarks. In the last 15 years the number of subfamilies in the family Polynoidae has been expanded from three to sixteen with one debatable addition (Table 1). This is remarkable since the status of the family Polynoidae has only recently gained wide acceptance. Only 21 years ago Day (1967) considered Polynoidae to be a subfamily of the family Aphroditidae. Although the recent proliferation of subfamilies suggests a dramatic change in the higher classification of the

Table 1. Sub families of *Polynoidae*

Sub family	*Author*
Iphioninae	Baird 1865
Lepidonotinae	Willey 1902
Harmothoinae	Horst 1917
Macellicephalinae	Hartmann-Schröder 1971
Bathyedithinae	Pettibone 1976
Polaruschakovinae	"
Macelloidinae	"
Macellicephaloidinae	"
Bathymacellinae	"
Admetellinae	Uschakov 1977
Polyodontinae	Muir 1982
Gesiellinae	"
Lepidonotopodinae	Pettibone 1983a
Branchipolynoinae	Pettibone 1984
Branchiplicatinae	Pettibone 1985a
Branchinotogluminae	Pettibone 1985b
Lepidastheniinae	Pettibone 1989b

polynoid scaleworms, earlier authors did recognise the presence of distinct groupings within the polynoid scaleworms irrespective of whether they considered the Polynoidae to be a subfamily or a family. Once the status of Polynoidae as a family was widely accepted, the elevation of most of these groupings to subfamily status was inevitable.

The three oldest subfamilies Iphioninae Baird, 1865, Harmothoinae, and Lepidonotinae, included all of the polynoid scaleworms until Hartmann-Schröder erected Macellicephalinae in 1971.

The majority of polynoid scaleworms have remained in the two large subfamilies Harmothoinae and Lepidonotinae. The new subfamilies which have been erected by Pettibone (1976, 1983a, 1984, 1985a,b, 1989a) and Uschakov (1977) contain polynoid species mostly from deep water and hydrothermal vents. The criteria for erection of new subfamilies for this deep water fauna are the presence of unusual morphological features not found on species of scaleworms in existing subfamilies (e.g. branchiae) and the absence of other features common among polynoid worms, such as a reduction in the number of antennae on the prostomium.

Muir (1982:174) erected a new subfamily Gesiellinae for *Gesiella* Pettibone, 1976, a genus with unusual accessory filamentous sensory organs. Muir also reduced Polyodontidae to subfamily level within the Polynoidae as the only difference between polyodontids and polynoids is the presence of spinning glands in the polyodontids. This has not been followed by Pettibone (1989b) in her revisionary study of the family Acoetidae Kinberg (=Polyodontidae Augener).

Therefore in spite of the creation of these new subfamilies the majority of polynoid scaleworms are still placed in either Lepidonotinae or Harmothoinae. The new subfamily Arctonoinae represents a group of genera which share a suite of morphologieal features which are not shared by other genera in Lepidonotinae or Harmothoinae. These features are indicated in the diagnosis of the subfamily.

Apart from *Arctonoe*, *Gastrolepidia*, *Bathynoe* Ditlevsen, 1917, and *Asteroplilia*, a new genus covered in this paper, I would also include the following genera: *Adyte* Saint-Joseph, 1899; *Paradyte* Pettibone, 1969a; *Subadyte* Pettibone, 1969a; *Pottsiscalisetosus* Pettibone, 1969a; *Australaugeneria* Pettibone, 1969a; *Hololepidella* Pettibone, 1969b, *Neohololepidella* Pettibone, 1969b; *Parahololepidella* Pettibone, 1969b; *Minisculisquama* Pettibone, 1983b; *Disconatis* Hanley and Burke, 1988.

Previously, (Hanley 1984) I have followed Muir (1982), and Tebble and Chambers (1982) in synonymising *Paradyte* and *Subadyte* Pettibone, 1969a with *Adyte* Saint-Joseph, 1899. Since then I have examined a lot more material and I now consider Pettibones' erection of these two genera to be valid.

It is important to note that a large number of the species in the genera listed above are commensals, predominantly with echinoderms. While it may be argued that these species may have acquired the commensal lifestyle independently, the great similarities of morphology of prostomium, parapodia, and setae suggest that all may have a common ancestor which was a commensal.

Genus *Arctonoe* Chamberlin

Arctonoe Chamberlin, 1920:6B (type species *Arctonoe lia* Chamberlin, 1920, by original designation. Referred to *Arctonoe vittata* by Hartman (1938:116). Gender feminine).

Halosydnoides Seidler, 1924:134 (type species *Polynoe vittata*, herein designated. Referred to genus *Arctonoe* by Hartman (1938:116). Gender feminine).

Diagnosis. Body elongated, flattened, with numerous segments (100 and more) tapering posteriorly. Elytra and prominent elytrophores, numerous pairs on segments 2, 4, 5, 7, alternate segments to 21, 23, 26, 28, 29, 31, 33, continuing on alternate segments to end of body, sometimes irregular sequence and\or asymmmetrical - elytron and dorsal cirrus on same segment. Elytra soft, translucent, without tubercles or papillae. Prostomium bilobed, without cephalic peaks, with two palps and three antennae with distinct ceratophores. Median antenna inserted in anterior notch; lateral antennae inserted terminoventrally with ceratophores converging midventrally. Two pairs of eyes, similar in size, lying close to each other on posterior half of the prostomium. First or tentacular segment not visible dorsally, tentaculophores lateral to

prostomium, achaetous, with two pairs of tentacular cirri, facial tubercle absent. Second or buccal segment with or without dorsal nuchal fold, with first pair of elytra on prominent elytrophores, subbiramous parapodia and ventral buccal cirri longer than following ventral cirri. Pharynx large, muscular, distally nine pairs of soft papillae encircling mouth and two pairs of chitinous jaws. Parapodia subbiramous, notopodia short, subconical; neuropodia larger, deeply incised distally with well developed presetal and postsetal lobes. Notosetae short, serrated with notched indented tips, Neurosetae longer, stouter, straight or hooked distally. Dorsal cirri with cylindrical cirrophore and distal styles. Dorsal tubercles moderately to well developed. Ventral cirri short, tapering to filiform tip, sometimes vestigial posteriorly. Nephridial papillae well developed, beginning on or about segment 6, continuing to end of body. Anus terminal, no anal cirri.

Commensal with echinoderms, molluscs, and other polychaetes.

Distribution. Northern and north-eastern Pacific Ocean.

Remarks. According to Chamberlin's original description of *Arctonoe* the elytra occur on segments "2, 4, 5, 7, 9, etc" whereas the correct arrangement is alternation on odd numbered segments of the body to 23, 26, 28, 29, 31, 33 and thereafter on alternating segments, but with some variability posteriorly including asymmetry, i.e. an elytron on one side of a segment and a dorsal cirrus on the other. This variability was first mentioned by Hartman (1938:115) and later endorsed by Pettibone (1953:56), and Uschakov (1982:116).

Seidler (1924) referred *Polynoe vittata* to a new genus *Halosydnoides*. However, the synonymy of *Arctonoe lia* with *Polynoe vittata* by Hartman (1938:116) means that Chamberlin's name *Arctonoe* has priority as the correct generic name.

Arctonoe vittata (Grube)
(Figs 1A-F, 2A-L, 3A-H)

Polynoe vittata Grube, 1855:82,83.

Acholoe vittata - Marenzeller 1902:576, Taf. III Fig. 13.

Halosydnoides vittata - Seidler 1924:134, 135; Monro 1928:312; Okuda 1936:565-568, Figs 4, 5.

Arctonoe vittata Hartman 1938:116; 1939:29, 30, Pl. 3 Figs 33-37; 1944:244; 1948:6, 11, 12, Fig. 2a-f; 1956:252, 260, 265; 1968:49; Berkeley and Berkeley 1941:23-24; 1942:188; 1948:20, 21, Figs 24, 25; Skogsberg 1942:489-497, Figs B-D; Hartman and Reish 1950:6; Pettibone 1953:57-61, Pl. 28 Figs 251-258, Pl. 29 Figs 259-271; Uschakov 1955:132, Fig. 23E,F; 1982:221, 223, Pl. XXXV Figs 1-7; Khlebovich 1961:166; Imajima and Hartman 1964:19; Buzhinskaja 1967:82; Banse and Hobson, 1974:26.

Lepidonotus lordi Baird, 1863:107.

Halosydna lordi - Baird 1865:190, 191; Moore 1908:330; Treadwell 1914:181; 1926:1; Chamberlin 1920:9B; Berkeley 1923:212.

Polynoe lordi - Johnson 1897:175-177, Pl. 7 Figs 35, 44, Pl. 8 Fig. 51; 1901:388-390; Treadwell 1923:4.

Halosydna succiniseta Hamilton, 1915: 234.

Arctonoe lia Chamberlin, 1920:6B, 7B, Pl. I Figs 1-4, Pl. II Figs 1-3; Annenkova 1937:146,147; 1938:131.

Halosydnoides lia - Annenkova 1934:322.

Type material. PARATYPES of *Arctonoe lia* - MCZ 2190, 2191a, Grantley Harbour, Teller, Alaska, station 20b-c, 30.vii.1913, 2-3 fathoms, sandy bottom; MCZ 2191, Point Clarence, Alaska, station 20g, 4.viii.1913, 2-3 fathoms, mud; VMM 16-56 (cat no. 29, or 27, 28), Port Clarence, Alaska, station 20g, 4.viii.1913, 2-3 fathoms, F. Johansen.

Additional material. AHF N6706, Northern California, from *Diadora aspera*, 4 specimens.

Description. Body flattened, widest part of body about 1/3 from head, tapering rapidly anteriorly, gradually posteriorly, fragile. Length 12-50mm, width 3-7mm. Numerous body segments (36-80). Dorsal and ventral surfaces of body variably pigmented. Some specimens (AHF) with light, streaky brown transverse bands across dorsal surface, and one broad brown band on segment 8. Pigmentation of specimens varying considerably according to host (Pettibone 1953).

Numerous pairs of large, soft, smooth elytra attached on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 28, 29, 31, 33, thereafter attachment pattern varying between specimens, usually on alternating segments to end of body but with some elytra on consecutive segments and often asymmetrical. Variation

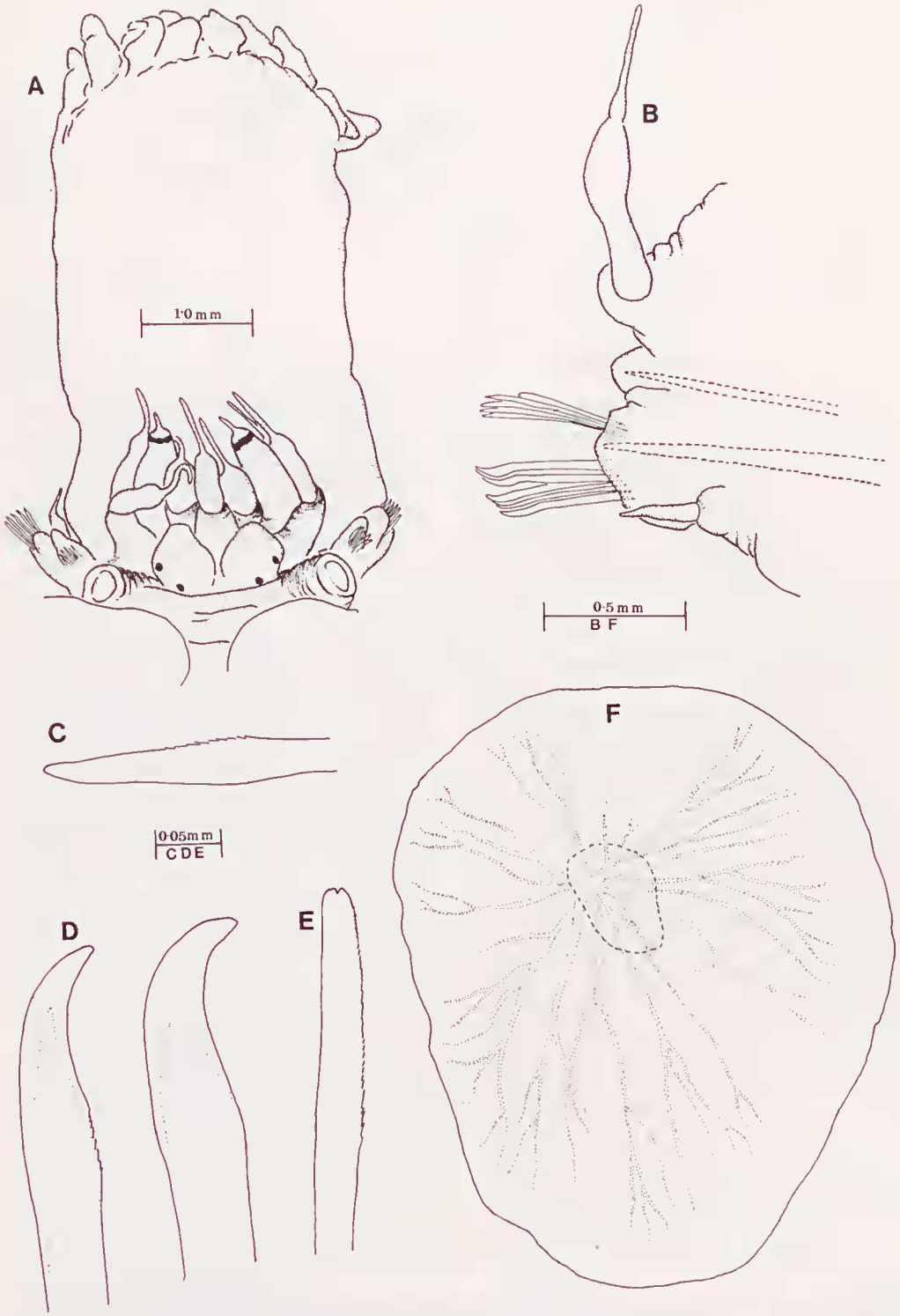

Fig. 1. *Arctonoe vittata* AHF N6706, large gravid female : **A**, anterior end; **B**, cirrigerous parapodium from 36th segment; **C**, lower neuroseta; **D**, middle neurosetae; **E**, upper neuroseta; **F**, elytron.

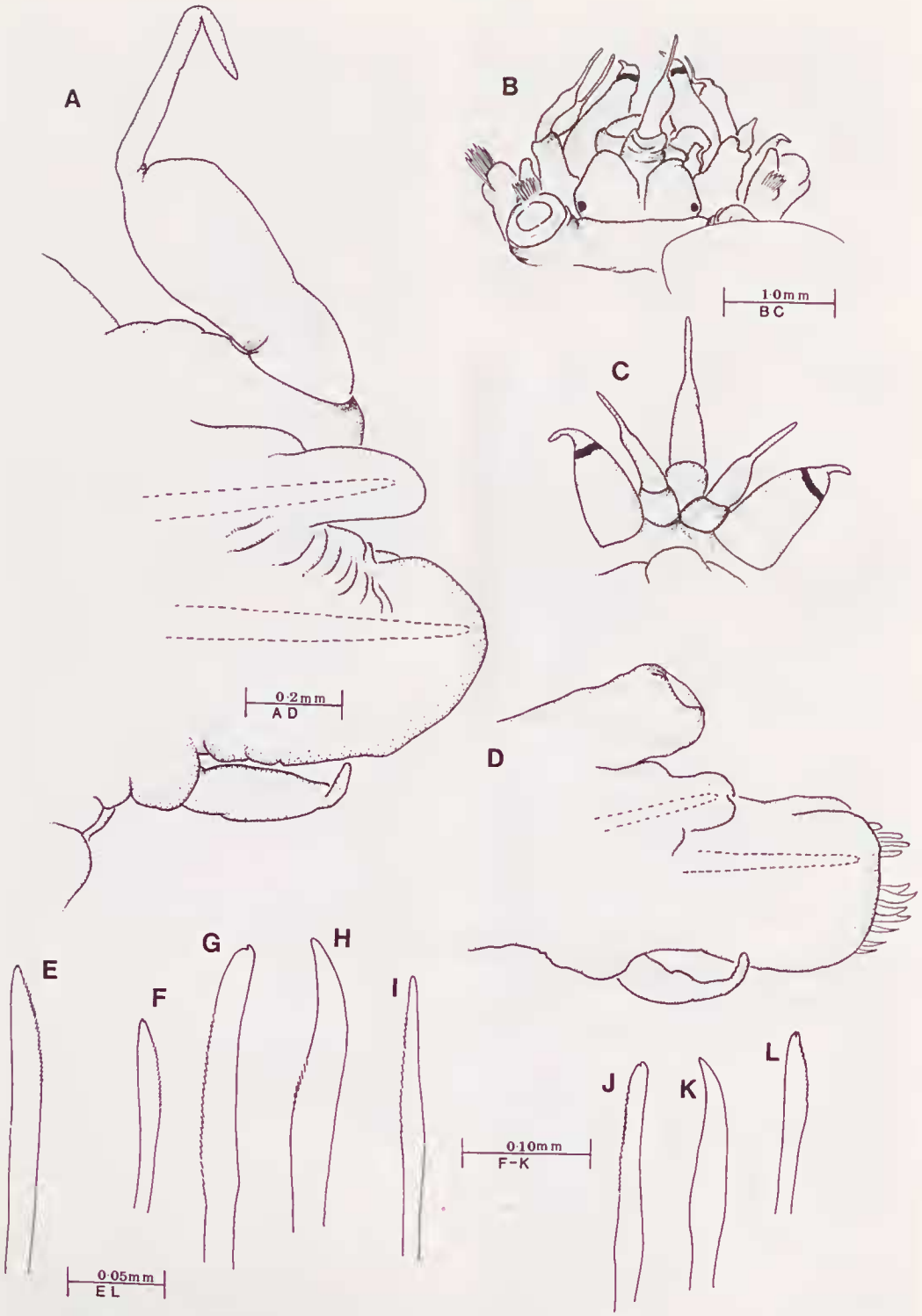

Fig. 2. *Arctonoe vittata* AHF N6706, large gravid female: **A**, cirrigerous parapodium from 3rd segment, anterior view; **E, F**, notosetae from same; **G**, upper neuroseta; **H**, middle neuroseta; **I**, lower neuroseta. AHF N6706, smaller specimen: **B**, anterior end, dorsal view; **C**, ventral view of prostomium; **D**, cirrigerous parapodium from 3rd segment, anterior view; **J**, upper neuroseta; **K**, middle neuroseta; **L**, notoseta.

Table 2. Variation in elytron attachment pattern on specimens of *Arctonoe vittata*

Specimen	*Length*	*Width*	*No. of segments*	*Elytra attached on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 28, 29, 31, 33, and thereafter on segments:*	*No. of elytra pairs*
A. lia paratype VMM	12.3mm	3.2mm	45	35, 37, 39, 41, 43, 45	23
A. lia paratype MCZ	22.4mm	3.5mm	55	35, 37, 39, 41, 43, 45, 48, 50, 52, 54 left side 35, 37, 39, 41, 43, 45, 47, 50, 52, 54 right side	27
A. lia Type VMM	15mm	3.0mm	52	35, 37, 39, 41, 43, 45, 47, 49, 51	26
AHF N6706 (3)	48mm	6.0mm	76	35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75 left 34, 35, 37, 38, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75 right	39 left 41 right
AHF N6706 (2)	35mm	4.0mm	63	35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54	30 left 29 right
AHF N6706 (1)	50mm	6.7mm	80	35, 37, 39, 41, 43, 45, etc, alternating to 75, 77, 79	40
AHF N6706 (4)	32mm	–	64	35, 37, 38, 40, 42, etc. alternating to 60, 62, 64	33

of elytral attachment pattern on the specimens examined is given in Table 2.

Elytra without tubercles, fringe of papillae, or frilled margins (Figs 1F, 3E). Elytra overlap each other posteriorly and first pair overlapping medially hiding prostomium but rest of dorsum exposed medially.

Prostomium bilobed, much wider than long, without cephalic peaks (Figs 1A, 2B, 3A). Two pairs of eyes, anterior pair small, lying dorsolaterally just behind widest point of prostomium, posterior pair lying dorsally close behind first pair, lying slightly closer to midline. Palps, short, stout with abruptly tapered tips. Three antennae. Median antenna with large cylindrical ceratophore inserted in anterior notch, style smooth, basally cylindrical, with subterminal inflation (sometimes not well defined) and a relatively long filiform tip. Lateral antennae with distinct ceratophores shorter and thinner than median ceratophore, inserted terminoventrally on prostomium (Figs 1A, 2B, 3A) and converging midventrally (Figs 2C, 3C), styles similar to median style but shorter.

Tentacular (first) segment achaetous, not visible dorsally, tentaculophores lateral to prostomium, two pairs of dorsal and ventral tentacular cirri, with smooth styles, similar in length and shape to style of median antenna. Facial tubercle very weakly developed. Segment 2 without nuchal fold, with first pair of elytra, subbiramous parapodia, notosetae, neurosetae, and ventral buccal cirri longer than following ventral cirri.

Parapodia subbiramous (Figs 1B, 2A,D, 3B,D). Notopodium small, subconical, on anterodorsal face of large neuropodium. Anterior notopodia well developed, becoming less so posteriorly, particularly on large specimens. Neuropodium deeply cut dorsally and ventrally (Figs 1B, 2A,D, 3B,D) with rounded presetal lobe and slightly shorter, rounded postsetal lobe. Dorsal cirrophores on segments without elytra, large, cylindrical, styles basally cylindrical, with subterminal inflation and long filiform tip. Ventral cirri short, basally inflated with long filiform tip. Nephridial papillae well developed, beginning on segments 6-12, continuing to end of body.

Notosetae (Figs 2E,F,L, 3F) short, curved slightly, with notched tips and rows of serrations. Notosetae decreasing in number posteriorly on smaller specimens and often absent from all but a few anterior segments on larger specimens. Neurosetae longer, larger, than notosetae, present on all segments, with subdistal swelling, upper ones with prominent rows of serrations (Figs 1E, 2G,J, 3H) and notched tips, middle and lower ones (Figs 1C,D, 2H,I,K, 3G) with very faint rows of serrations and strongly curved unidentate tips (often broken); neurosetae in middle of bundle intermediate between the two extremes.

Pygidium small, anus terminal, anal cirri absent.

Commensal on or with wide variety of echinoderms, molluscs, and polychaetes.

Distribution. North Pacific: Japan, Kurile Islands, Okhotsk and Bering Seas, Alaska south to California and Ecuador.

Remarks. The location of the type specimen/s of *Polynoe vittata* is unknown. Most of the material described by Grube is housed in the Naturhistorisches Museum in Berlin.

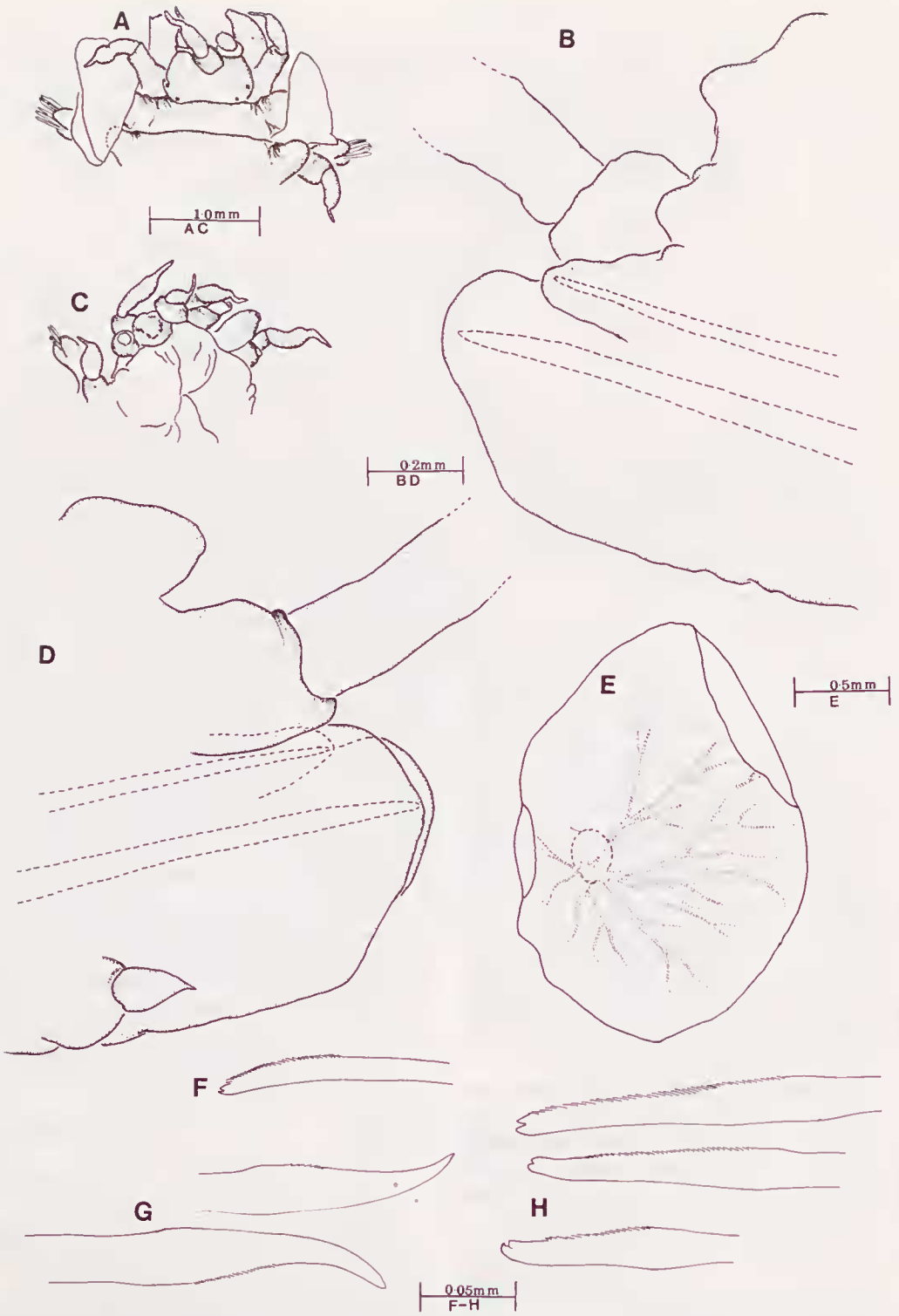

Fig. 3. *Arctonoe vittata* (paratype of *Arctonoe lia* Chamberlin) MCZ 2191: **A,** anterior end, dorsal view; **B,** anterior cirrigerous parapodium, anterior view; **C,** ventral view of anterior end; **D,** anterior cirrigerous parapodium, posterior view; **E,** right 4th elytron from segment 7; **F,** notoseta; **G,** middle neurosetae; **H,** upper neurosetae.

However correspondence with Dr. G. Hartwich indicates there is no type material of this species in that Institution. Several types of species erected by Grube are held in the Wroclaw Museum, Poland, listed in Wiktor (1980), but the type of this species is not among them.

The original description of *Polynoe vittata* by Grube (1855) mentions that the elytra are smooth, soft and found on segments 2, 4, 5, and alternating segments to 26, 28, 29, 31, and then on alternating segments to the end of the body. The description of elytron arrangement up to segment 31 agrees well with subsequent descriptions of specimens referred to this species. In addition Grube describes the notosetae as small, blunt tipped, with rows of fine serrations and states they are few in number or absent altogether on most specimens. He describes the neurosetae as much larger than the neurosetae with lanceolate tips, the upper ones with rows of serrations, the lower ones unidentate and with slightly curved tips. Therefore the original description is sufficient to allow discrimination between this species and the very similar *A. pulchra* which does not have two forms of neurosetae.

The paratypes of *A. lia* are in poor condition, all having been dry for some period of time and therefore distorted with most appendages such as cirri and antennae missing. However the pattern of elytron attachment is consistent with that documented here and elsewhere for the genus *Arctonoe* and all the paratypes possess the two forms of neurosetae described by Grube so I have no hesitation in supporting the synonymy of *A. lia* with *A. vittata*, as first proposed by Hartman (1938).

Unfortunately the type of Baird's *Lepidonotus lordi* must be considered lost as it is not in the collection of the British Museum of Natural History (Alex Muir pers.comm.). The original description of this species (Baird 1863) is poor, particularly as it gives no clue to the pattern of elytron attachment and it does not adequately describe the setae. A later description of the species by Baird (1865) as *Halosydna lordi*, is more useful as it describes the presence of two forms of neurosetae, similar to those described for *A.vittata* by Grube. Other features described by Baird, which lend credence to the synonymy of *L. lordi* with *A. vittata*, are the colour pattern of the specimens, the numerous pairs of elytra, and the association of all the specimens with the mollusc *Fissurella cratitia*, a known host of *A. vittata*.

In the paper describing *A. lia*, Chamberlin (1920) also mentions a specimen of *Halosydna lordi* , and so obviously did not consider it synonymous with his own species. He provides a record of one specimen and claims that its distinctive colour pattern suggests it should be referred it to *H.lordi*; one can only assume in the absence of a comprehensive description that he did not examine this specimen closely, so this record should be regarded with some suspicion.

Arctonoe fragilis (Baird)
(Figs 4A-F, 5A-F)

Lepidonotus fragilis Baird, 1863:108.

Halosydna fragilis - Baird 1865:191, 192; Berkeley 1923:212; 1924:193.

Polynoe fragilis - Johnson 1897:179-181, Pl.VII, Figs 36, 45, Pl.VIII, Figs 52, 52a; 1901:390; Moore 1908:332; Treadwell 1914:181.

Acholoe fragilis - Hartman 1936:32.

Arctonoe fragilis - Hartman 1938:116; 1944:244; 1948:11; 1968:45, Figs 1-3; Berkeley and Berkeley 1942:188; 1948:20, Fig. 23; Hartman and Reish 1950:6; Pettibone 1953:64-66, Pl. 31, Figs 281-290; Banse and Hobson 1974:26; Uschakov 1982:116.

Material. AHF N10, outer side of Tamales Point, California, 9.vi.1941, commensal in ambulacral groove of *Pisaster giganteus*, 2 specimens.

Description. Body large, flattened, elongate, widest about 1/3 from anterior end, tapering rapidly anteriorly, more gradually posteriorly. Numerous segments (up to 100). The smaller of the two specimens is 23mm, the larger specimen 50mm in length. The width, including parapodia, of smaller specimen is 2.5mm, and the width of the larger specimen is 5mm. Dorsal and ventral surfaces of body without pigmentation (due to preservation), live animals tending to match coloration of host (Pettibone 1953).

Numerous pairs of large, soft, smooth elytra attached on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 28, 29, 31, 33, thereafter attachment pattern varies between specimens, usually on alternating segments to end of body but with some elytra on consecutive segments and sometimes asymmetrical. On

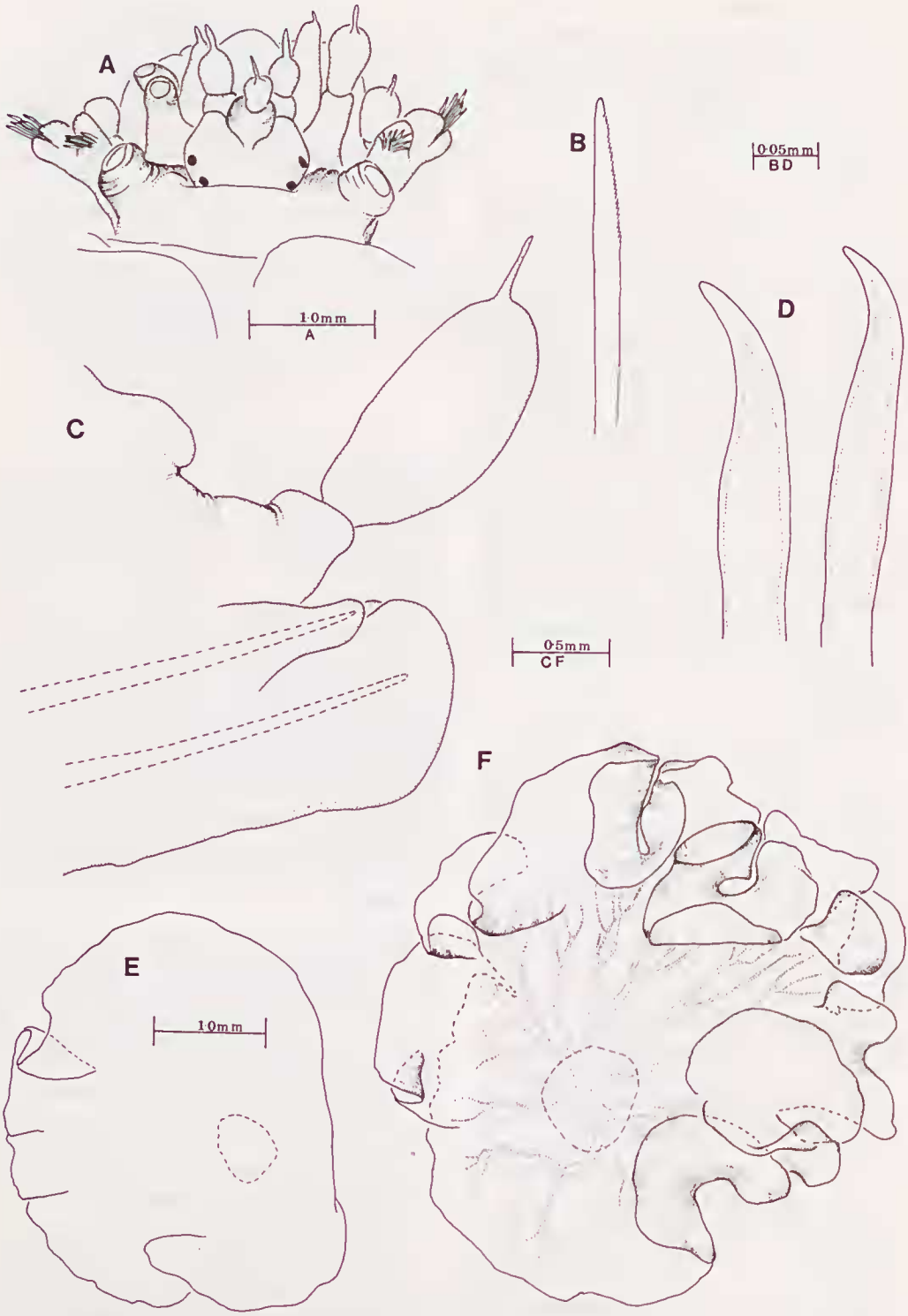

Fig. 4. *Arctonoe fragilis* AHF N10, large specimen: A, anterior end, dorsal view; B, notoseta; C, parapodium from segment 12, anterior view; D, neurosetae; E, posterior elytron; F, anterior elytron.

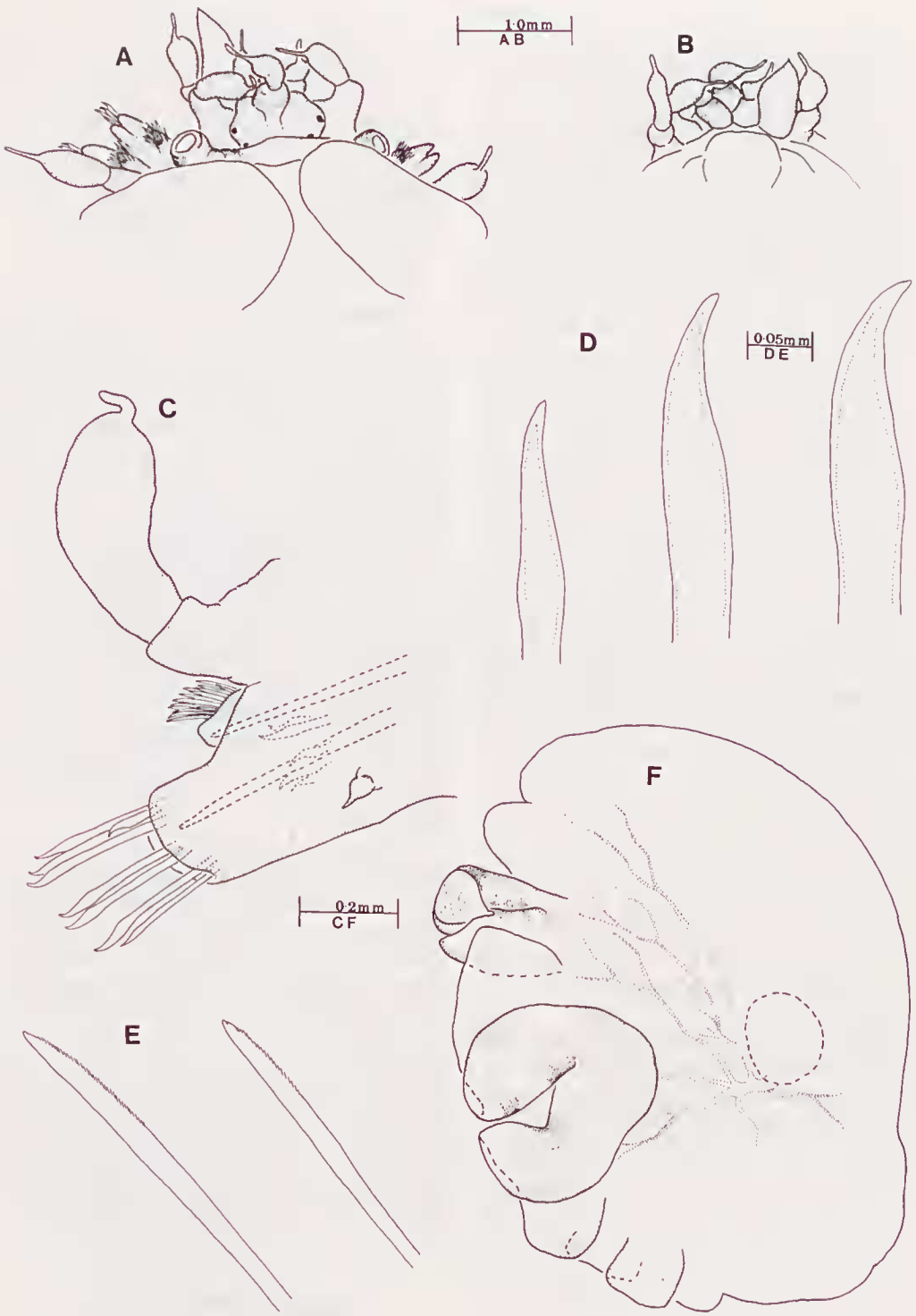

Fig. 5. *Arctonoe fragilis* AHF N10, small specimen: **A**, anterior end, dorsal view; **B**, ventral view of anterior end; **C**, posterior view of cirrigerous parapodium from segment 12; **D**, neurosetae; **E**, notosetae; **F**, anterior elytron.

smaller of two specimens examined, elytra on segments 35, 37, 39, 41, 43, 45,and 47. On large specimen elytra on segments 35, 37, 39, 40, 42, 44, 46, 48, 50, 51, 53, 55, and 57 on left side, and on right side on segments 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60. Elytra (Figs 4E,F, 5F) without tubercles or fringe of papillae, with margin conspicuously convoluted and folded (frilled), particularly on anterior elytra, becoming less so posteriorly. Elytra overlapping each other posteriorly but not in midline, thus exposing prostomium and dorsum exposed medially.

Prostomium bilobed, much wider than long, without cephalic peaks (Figs 4A, 5A). Two pairs of eyes, anterior pair small, lying dorsolaterally at the widest part of the prostomium, posterior pair similar size, lying relatively close behind first pair, closer to midline. Palps, short, stout, with abruptly tapered, short, filiform tips. Median antenna with large cylindrical ceratophore inserted in anterior notch, style smooth, short, basally inflated with relatively long filiform tip. Lateral antennae on distinct ceratophores shorter and thinner than median, inserted terminoventrally on prostomium (Fig. 5B), converging midventrally, antennae similar in shape to median antenna but slightly shorter.

Tentacular (first) segment, not visible dorsally, large tentaculophores lateral to prostomium, achaetous, with two pairs of tentacular cirri, smooth, basally cylindrical, with prominent subterminal inflation and long filiform tip, similar in length or longer than median antenna. Facial tubercle poorly defined. Segment 2 without nuchal fold, with first pair of elytra, subbiramous parapodia, and long ventral buccal cirri.

Parapodia subbiramous (Figs 4C, 5C). Notopodium small, subconical, with notoacicula, on anterodorsal face of much larger neuropodium. Neuropodium short, blunt, deeply cut dorsally (Fig. 4C, 5C), with presetal lobe bluntly rounded, acicula does not protude, postsetal lobe shorter, rounded. Cirrophores of dorsal cirri on segments without elytra, large, cylindrical, styles thick, with large subdistal inflation abruptly tapering to filiform tip (Figs 4C, 5C). Ventral cirri vestigal, button-like after first few segments. Nephridial papillae conspicuous on one specimen from segment 6 to end of body.

Notosetae (Figs 4B, 5E) short, thin, not curved, slender tips, sometimes notched, with rows of fine serrations. Neurosetae (Figs 4D, 5D), longer, stout, with subdistal swelling, tips sharply tapered, strongly hooked, some with fine serrations, relatively few neurosetae present on each segment, some newly formed ones visible inside parapodia.

Pygidium small, inconspicuous, anus terminal, anal cirri not evident. Pharynx not everted. Commensal with asteroids.

Distribution. North-eastern Pacific: Alaska to central California.

Remarks. The type specimen/s of *Lepidonotus fragilis* are not in the British Museum of Natural History (Alex Muir pers. comm.). The original description is also deficient in several respects (admitted by Baird). In particular, there is no mention of the number of pairs of elytra or their arrangement, although this is because the worms were fragmented (their fragile condition is reflected in the species name), and there is no mention of frilled margins on the elytra.

The characteristic which has allowed subsequent authors to ascribe specimens to Baird's species is the reduction of the ventral cirri to rudimentary knobs, particularly on the posterior segments of the body, a characteristic described by Baird. Another feature which has been useful in referring specimens to Baird's species is its association with asteroids.

The specimens examined here and the descriptions provided by subsequent authors agree for the most part with the original description. However one significant discrepancy is Baird's description of the notosetae as "short, straight and simple, not toothed or serrate on the edges" (Baird 1863). All the specimens I have examined, and those that have been previously referred to this species, have notosetae which are serrated and have notched tips. The status of this species could therefore be considered to be doubtful, except that there are no other species known which have the features of rudimentary ventral cirri, commensal on starfishes, northeastern Pacific distribution and fragile body.

Arctonoe pulchra (Johnson)
(Figs 6A-F, 7A-H)

Polynoe pulchra Johnson, 1897:177-179, Pl.VII, Figs 34, 43, 43a, Pl.VIII, Figs 50, 50a, 50b; 1901:390.

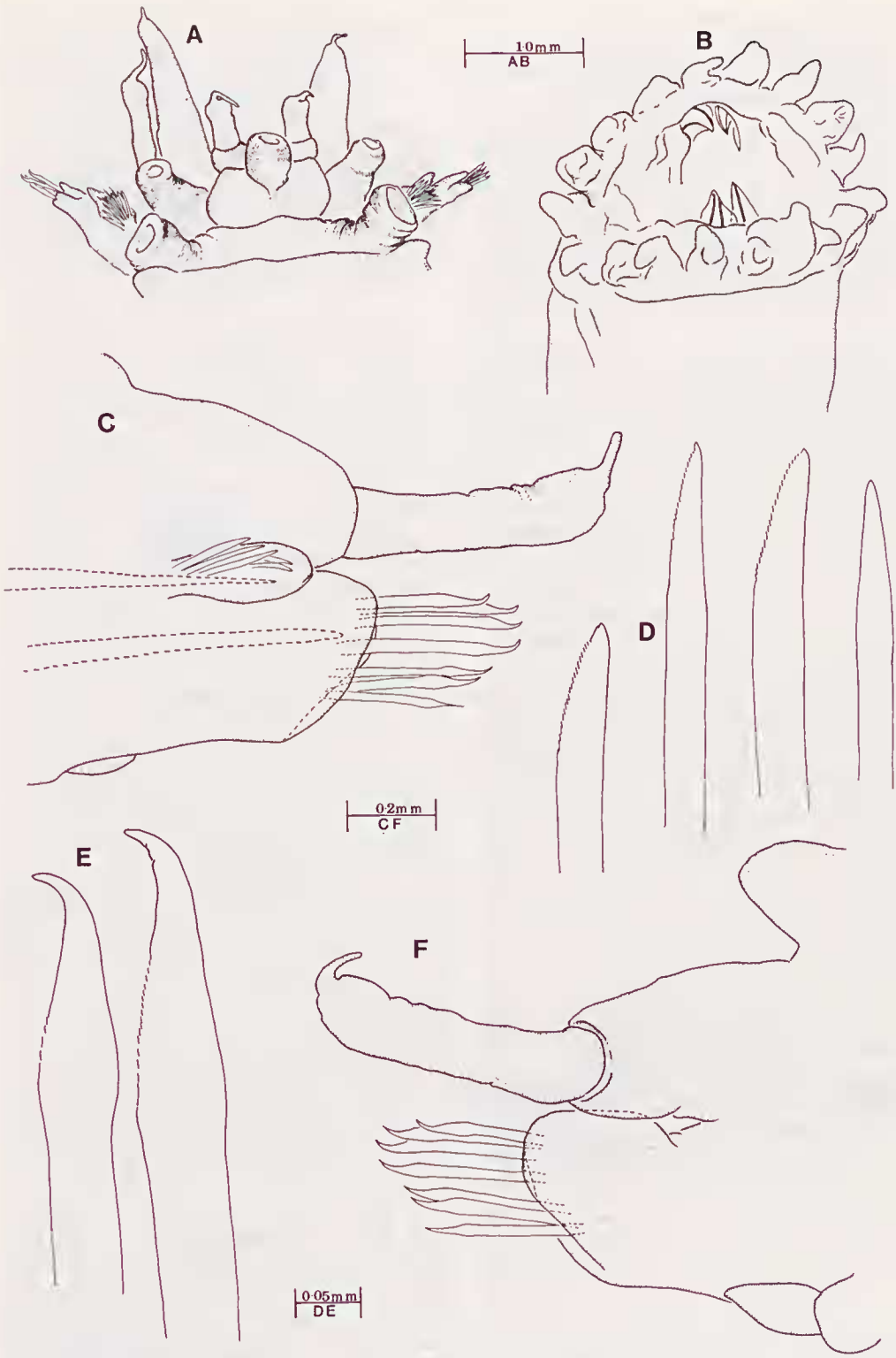

Fig. 6. *Arctonoe pulchra*, syntype of *Polynoe pulchra* ZMH PE 127b: **A**, anterior end, dorsal view, eyes faded; **B**, distal end of everted pharynx; **C**, anterior view of cirrigerous parapodium from segment 12; **D**, notosetae; **E**, neurosetae; **F**, posterior view of cirrigerous parapodium from segment 12.

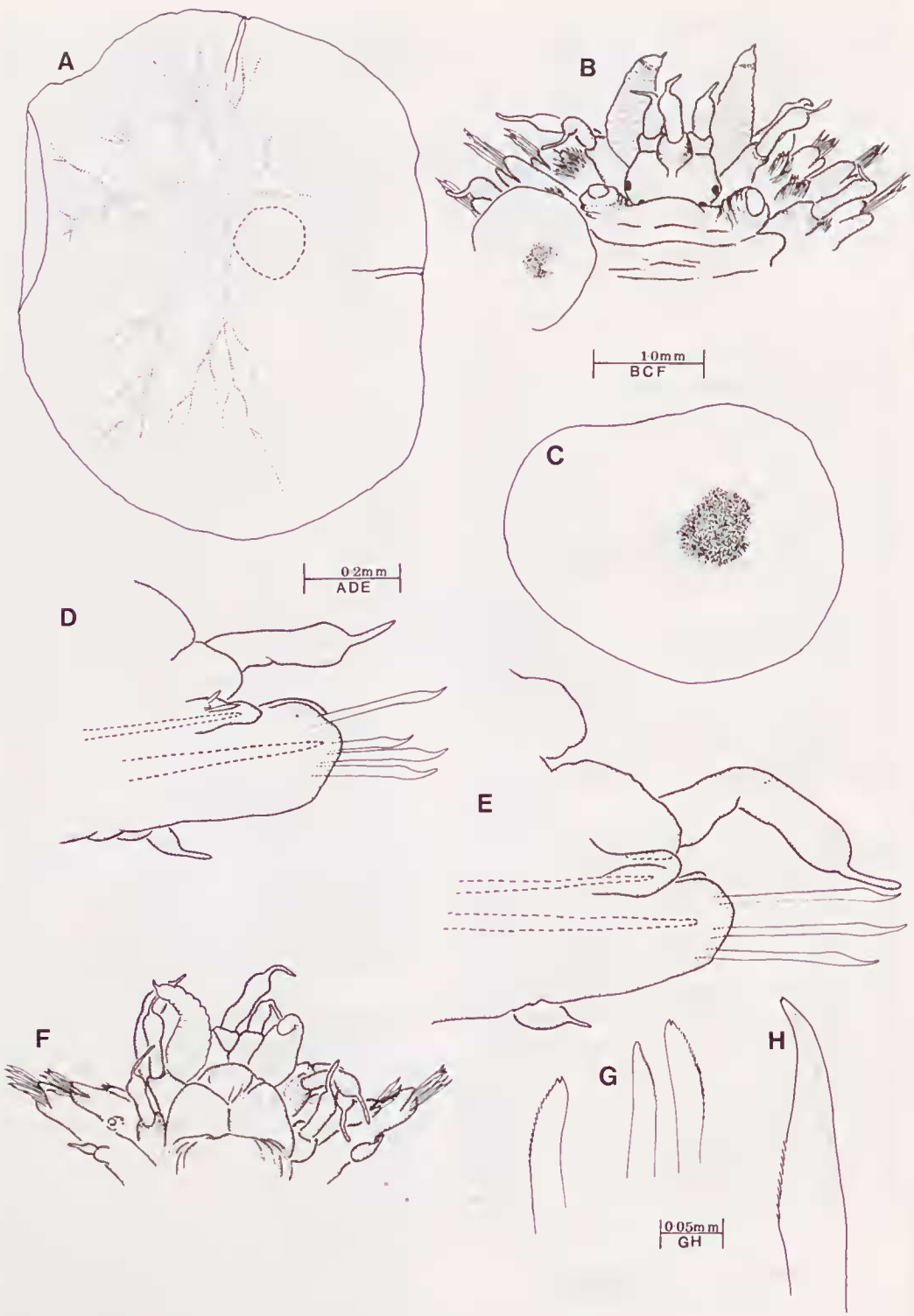

Fig. 7. *Arctonoe pulchra* ZMH PE 127b: **A**, elytron. AHF 1170-40: **B**, anterior end, dorsal view; **C**, elytron; **D**, cirrigerous parapodium from segment 6, anterior view; **E**, cirrigerous parapodium from segment 12, anterior view; **F**, ventral view of anterior end; **G**, notosetae; **H**, neuroseta.

Halosydna pulchra - Moore 1908:329-330; 1909:240; 1910:328-329; Treadwell 1914: 179; Berkeley 1923:212; 1924:193.

Acholoe pulchra - Hartman 1936:32.

Lepidasthenia pulchra - Treadwell 1937: 144-145.

Arctonoe pulchra - Hartman 1938:116; 1948:6; 1968:47; Banse and Hobson 1974:26; Berkeley and Berkeley 1941:24; 1942:188; 1948:21; Skogsberg 1942:497-500, Fig. D 6-8; Pettibone 1953:61-64, Pl. 30, Figs 272-280; Usehakov 1982:116.

Halosydna leioseta Chamberlin, 1919:2.

Halosydnoides vittata var. *pulchra* Seidler, 1924:136.

Type material. SYNTYPE - HZM PE 127b, label reads " Polynoe pulchra TYPEN-MATERIAL",

Additional material. AHF 1170-40, Southern California, Santa Catalina Island, 33°26' 45" – 33° 27' 10" N, 118° 27'10" – 118° 28'30" W, trawl, 80-100 fathoms, sponge gravel and sand, 10.viii. 1940, 13 specimens.

Description. Body dorsally flattened, widest about 1/3 from head, tapering rapidly anteriorly, gradually posteriorly. Length 10-26mm, width including parapodia 3-9.5mm. Variable number of segments (32-52), increasing with size. Dorsal and ventral surfaces of body without pigment.

Numerous pairs of large soft elytra attached on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 28, 29, 31, 33, thereafter on alternating segments to end of body. One specimen with asymmetrical arrangement of elytra after segment 39, with on the left side a pattern similar to the other specimens but on the right side the elytra were found on segments 39, 40, 41, 44, 46, 48, and 50. Elytra smooth, without tubercles or papillae, with smooth margins, slightly folded on some specimens (Fig. 7A,C). Elytra overlap posteriorly, and often medially, covering dorsum entirely on some specimens. Some specimens with a large central dark brown spot on elytra (Fig. 7C).

Prostomium bilobed, much wider than long, without cephalic peaks (Figs 6A, 7B). Two pairs of eyes, anterior pair moderate size, circular to oval, lying laterally at widest part of prostomium, posterior pair near posterior border, relatively close behind anterior pair and closer to midline. Palps short, stout, with abruptly tapered tips, and, on most specimens examined, some faint, irregular annuli (Fig. 7B). Median antenna with large, cylindrical ceratophore inserted in anterior notch, style smooth, basally cylindrical, expanding into subterminal inflation and a long filiform tip. Lateral antennae with distinct ceratophores shorter and thinner than median ceratophore, inserted terminoventrally on prostomium (Figs 6A, 7B), converging midventrally (Fig. 7F), antennae shorter than median antenna, basally cylindrical, expanding into slight subterminal inflation and long filiform tip.

Tentacular (first) segment not visible dorsally, achaetous (although one of the specimens had a seta on the base of the right tentaculophore), tentaculophores moderately long, lateral to prostomium, two pairs of tentacular cirri, smooth, similar length and shape, to median antenna. Facial tubercle poorly developed. Segment 2 without nuchal fold, with first pair of elytra, subbiramous parapodia, and ventral buccal cirri longer than following ventral cirri.

Parapodia subbiramous (Figs 6C,F, 7D,E). Notopodium small, digitiform, on anterodorsal face of much larger, neuropodium. Neuropodia deeply cut dorsally forming bluntly rounded presetal and postsetal lobes of similar length, presetal sometimes slightly longer, (Figs 6C,F, 7D,E). Cirrophores of dorsal cirri on segments without elytra, large cylindrical, styles thick, basally cylindrical expanding into weak subterminal inflation and short filiform tip. Dorsal tubercles conspicuous knobs. Ventral cirri short, subulate. Nephridial papillae well developed on larger specimens, beginning on segments 6-12, continuing to end of body, on smaller specimens papillae often inconspicuous. Notosetae (Figs 6D, 7G) short, slightly curved, with rows of serrations and tips blunt or notched. On small specimens notosetae present on all parapodia, decreasing in number posteriorly; on larger specimens notosetae present only on anterior segments. Neurosetae large, stout, present from segment 2 onwards, with prominent subdistal swelling, faint rows of serrations and strongly bent unidentate tips (Figs 6E, 7H).

Pygidium small, anus terminal, no evidence of anal cirri. Commensal with asteroids, holothurians, echinoids, molluscs and terebellid polychaetes.

Distribution. Northeast Pacific: Alaska to lower California.

Remarks. Johnson's (1897) description of this species was based on specimens collected from holothurians and keyhole limpets. All of the polychaete material described in his paper was deposited in the Museum of the University of California (Johnson 1897:155). Curiously, a request for material sent to a number of European Museums produced a specimen from the Hamburg Museum which is labeled as" Co-type *Polynoe pulchra*". At first, I considered the status of this specimen as doubtful as there is no mention by Johnson of an intention to deposit type specimens overseas. However, Dr Gesa Hartmann-Schröder (pers. comm.) has confirmed that the specimen was given to Ehlers either by Johnson or someone at the University of California Museum.

The description of the species given by Johnson is a good one, providing vital information on the number of elytra, the pattern of arrangement on the body and the species is well figured. The species is similar to *A. vittata* but can be distinguished from it primarily by the presence of only one kind of neuroseta. I have not been able to find on the specimens I have examined the short, close set papillae on dorsolateral body lobes, parapodia, and dorsal tubercles as described by Pettibone (1953). Nevertheless there is good general agreement with the original description.

Genus *Gastrolepidia* Schmarda 1861

Gastrolepidia Schmarda 1861:159 (type species *Gastrolepidia clavigera* Schmarda, 1861, by monotypy. Gender: feminine).

Diagnosis. Body flattened, elongate, segments up to 60. Elytra large, smooth, margins with pocket-like fold on inner margin, up to 31 pairs on prominent elytrophores on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 29, 32, 35, 36, and thereafter usually on alternating segments to end of body but sometimes with considerable variation including asymmetry. Conspicuous ventral lamellae at the base of each parapodium from segment 3 onwards. Prostomium bilobed, much wider than long, without cephalic peaks, with three clavate antennae. Median antenna ceratophore large, inserted in anterior notch, Lateral antennae with distinct ceratophores inserted terminoventrally on prostomium, converging midventrally on the underside of the prostomium. Two palps, short, slender tapering gradually to fine tips. Two pairs of eyes, on posterior half of prostomium. First or tentacular segment not visible dorsally, facial tubercle a well developed knob, tentaculophores lateral to the prostomium, achaetous, with two pairs of dorsal and ventral tentacular cirri, smooth. Second or buccal segment with conspicuous semilunar nuchal fold, with first pair of elytra on prominent elytrophores, subbiramous parapodia and ventral buccal cirri much longer than following ventral cirri. Pharynx large, muscular, distally eleven pairs of soft papillae encircling mouth with two pairs of chitinous jaws. Parapodia subbiramous, notopodia small, with long spatulate acicular lobe, neuropodia larger, deeply incised dorsally and ventrally forming well developed presetal and postsetal lobes. Notosetae short to long, curved, with rows of serrations along the outer edge, and notched tips. Neurosetae longer, of two kinds: upper ones slender, with many rows of serrations and hooded, notched tips; middle and lower ones much stouter with fewer rows of serrations and slightly curved, unidentate tips. Dorsal cirri with cylindrical cirrophores and clavate styles. Dorsal tubercles indistinct. Ventral cirri short, smooth, tapering gradually to filiform tips. Nephridial papillae usually well developed, beginning on segments 6-8, continuing to end of body. Anus terminal, a pair of anal cirri on short cirrophores, styles very similar to styles of antennae and dorsal cirri.

Distribution. Tropical Indo-West Pacific.

Remarks. *Gastrolepidia* is similar to *Arctonoe* in prostomial features, such as eye position, insertion of lateral antennae, lack of cephalic peaks, and shape of antennae. The body is elongate with a variable number of soft flexible elytra, as in species of *Arctonoe*. The neuropodia are similarly deeply cut dorsally and ventrally, forming distinct anterior and posterior lobes and the notopodium is small. The middle and lower neurosetae resemble those of *Arctonoe*, and the notosetae show some similarities. For these reasons *Gastrolepidia* is also placed in the new subfamily Arctonoinae. Major differences between *Gastrolepidia* and *Arctonoe* are the

pattern of elytron attachment, the presence of ventral lamellae on *Gastrolepidia*, and the long, fine, hooded upper neurosetae of *Gastrolepidia*.

Gastrolepidia clavigera Schmarda
(Figs 8A-H, 9A-F, 10A-G)

Gastrolepidia clavigera Schmarda, 1861: 159, Pl. XXXVI, Fig. 316; Baird 1865: 173; Quatrefages 1865:287, 288; Grube 1876:69; Willey 1905:253; Potts 1910:341; Horst 1915a:11, 12; 1917:84, Pl. XVI, Fig. 5; Fauvel 1919:335; 1930:13, Pl. 1, Figs 16-19; 1932:25; 1940:254; 1947:19, Fig. 15a-d; 1953:51, Fig. 22d-f; Seidler 1924:142, Figs 19-20; Augener 1926:443, Fig. 2; 1927:361; Monro 1931:7; Hartman 1954:630, Figs 174B-E; Day 1967:51, Figs 1, 5a-f; Reish 1968:210; Gibbs 1969:447-449, Fig. 130; 1971:119; 1972:203; Uschakov 1982:118-120, Pl. XXXVII, Figs 8-12, Pl. XXXVIII, Figs 5, 6; Devaney and Bailey-Brock 1987:97, 98.

Gastrolepidia amblyphyllus Grube, 1876: 69; 1878:46, Pl. III, Fig. 7.

Polynoe freudenbergi Plate, 1916:18-21, Pl. 9, Figs 1, 2, Textfigs A-C.

Type material. SYNTYPES - NMW Inv. No. 296, Ceylon, coll. Musci Vindobonensis, 18??, 3 specimens, one complete in 3 pieces, and 2 anterior ends.

Additional material. MNHN No. 1923, Madagascar, Tamatave, 4.ii.1912, coral reef, W. Kaudern. MNHN A339, Indian Ocean (Mus.Calcutta), station 669, collection P. Fauvel, AHF N5932, Bikini Atoll. ZMA V. Pol. 320, Siboga station 60, Hiangsisi, Samau Island, Reef, from *Holothuria atra*, Siboga station 213, Palu Pasfi, Tanette litt. 2 specimens. NTM W3950, 3951, Singaraja, Bali, 13.iv.1984, coral reef, on *Bohadschia argus*, 2m, coll. C. Watson-Russell. AM W5133, Between Bird and South Islands, 27.xi.1985, Reef floor, from underside of *Bohadschia argus*, 10m, coll. Hutchings and Reid. AM W5144, same locality and collectors, from *Stichopus variegatus*, ?.xi.1985, 2 specimens. AM W5498, same locality, host and collectors, 24.xi.1985, 15m, 2 specimens. AM W5143, Granite Bluff, Lizard Island, 30.xi.1985, from underside of *Bohadschia argus*, 20m, coll. Hutchings and Reid.

ASHMORE REEF, NORTHWESTERN AUSTRALIA, 12° 14'S 122° 58'E: NTM W3952, on *Bohadschia argus*, 29.vii.1986, intertidal, coll. C. Johnson; NTM W4189, Coral rubble and sand, from holothurian, 27.vii.1986, 1m, coll. H. Larson; NTM W4998, on *Stichopus hermeni*, 24.ix.1987, low water, coll. A. Hoggett; NTM W4930, 4681, 4540, from *Bohadschia argus*, coral outcrop, 3-10m, 11.iv.1987, coll. R. Hanley, L. Vail; NTM W4447, on *Holothuria atra*, low water, 14.iv.1987, coll. R. Hanley; NTM W4420-4422, 4424, from *Holothuria atra*, reef flat, low water spring, 14.iv.1987, coll. R. Hanley; NTM W4724, on *Bohadschia argus*, Coral bommie, 18m, 19.iv.1987, coll. L. Vail; NTM W4728, 4532, on *Bohadschia argus*, lagoon, 2-10m, 20.iv.1987, coll. R. Hanley; NTM W4438, from *Holothuria atra*, reef flat, low water, 21.iv.1987, coll. R. Hanley; NTM W4431-4434, 4437, on *Bohadschia argus*, Reef flat, low water, 22.iv.1987, coll. R. Hanley.

HERON ISLAND, QUEENSLAND, coll. N. Coleman: AM W5626, Wistari Reef, on large green holothurian with black spots, 24.vii.1973; AM W6859, 10m, 25.xi.1971; AM W6890, from *Stichopus variegatus*, ?/12/1974; AM W8678, on holothurian, 8m, 23.vii.1975; AM W9166, on holothurian, 10m, 5.viii.1976. AM W5449, Warroora, northwestern Australia, on holothurian, 4ft, 19.vii.1972, coll. N. Coleman. AM W6014, 6015, John Brewer Reef, Queensland, on holothurians, 5m, 14.ii.1974, coll. N. Coleman. AMPI Worm No. 294, Lizard Island, Queensland, on holothurian, lagoon, 5m, 13.i.1979. Australian Museum, North Point, Lizard Island, found on *Bohadschia argus*, March, 1986, coll. Reid and Hutchings.

Description. Body flattened, widest part of body in anterior third, tapering anteriorly and posteriorly, with up to 63 segments.

Pigmentation of specimens extremely variable, depending on coloration of host (see Potts 1910; Gibbs 1969).

Elytra large, soft, smooth without papillae on margins (Figs 9C, 10A,B). Variable number of pairs of elytra (15-31) attached on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 29, 32, 35, and 36, thereafter attachment pattern varying between specimens, usually on alternating segments to end of body but some specimens with elytra on consecutive segments and/or asymmetrical (Table 3). Elytra overlapping medially and posteriorly (Fig. 9C). Elytron with pouch on

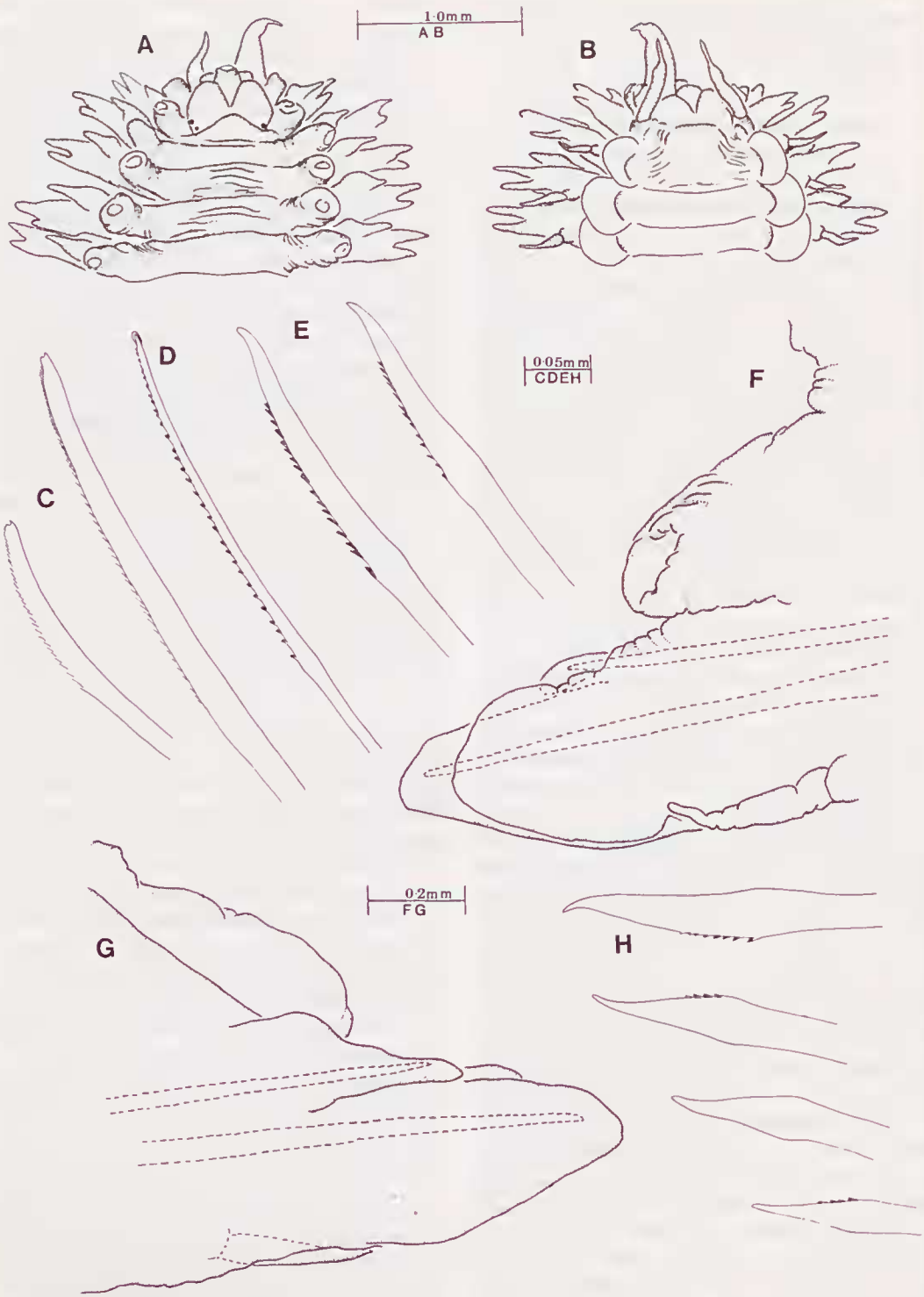

Fig. 8. *Gastrolepidia clavigera* syntype: A, anterior end, dorsal view; B, ventral view of anterior end; C, notosetae; D, upper neuroseta; E, middle neurosetae; F, posterior view of cirrigerous parapodium, style of dorsal cirrus missing ; G, anterior view of same; H, middle and lower neurosetae.

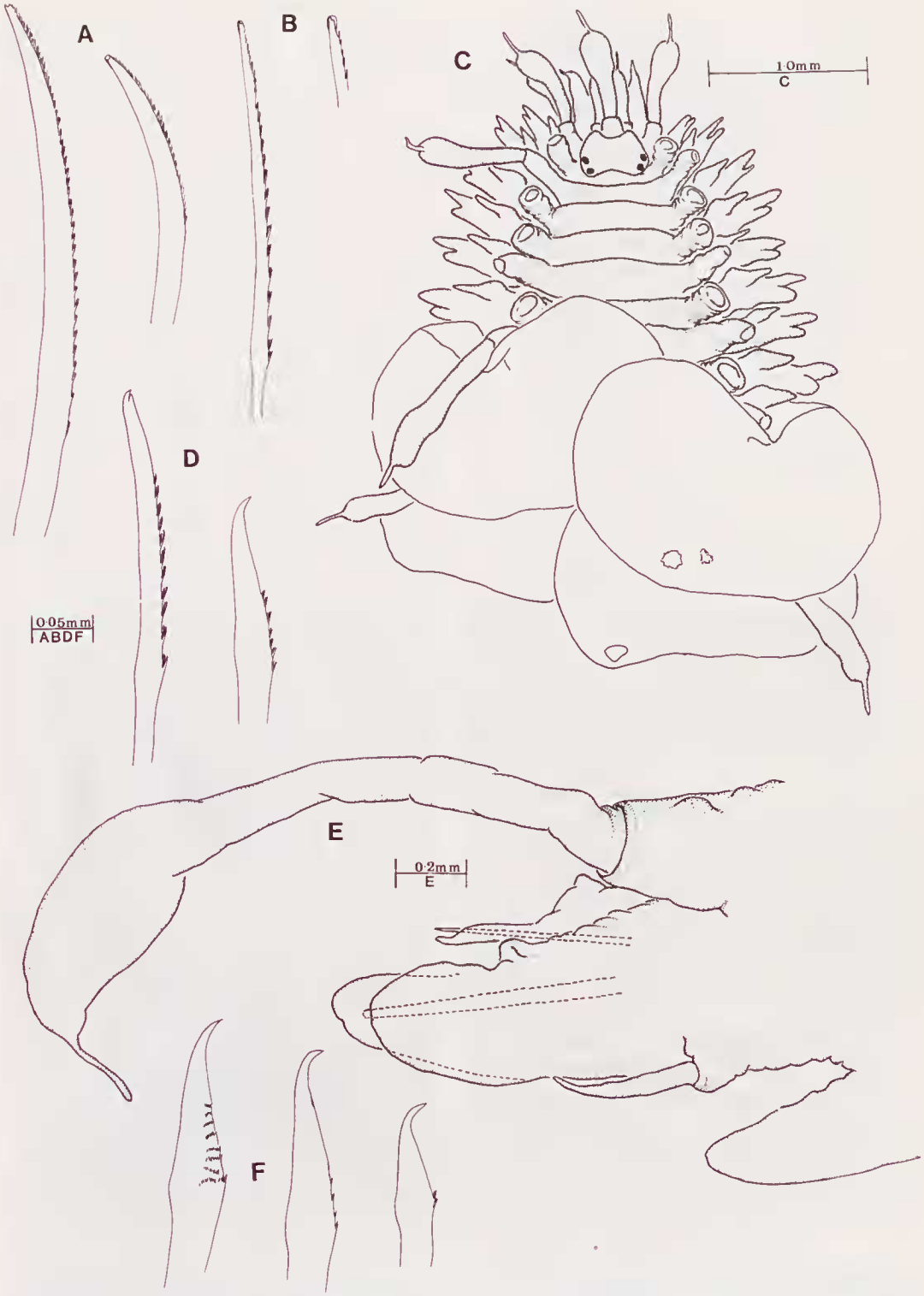

Fig. 9. *Gastrolepidia clavigera* MNHN A339, **A,B,D-F**; NTM W4420, **C**,: **A**, notosetae; **B**, upper neuroseta; **C**, dorsal view of anterior end showing orientation of dorsal cirri and elytra; **D**, middle neurosetae; **E**, cirrigerous parapodium, posterior view; **F**, middle and lower neurosetae.

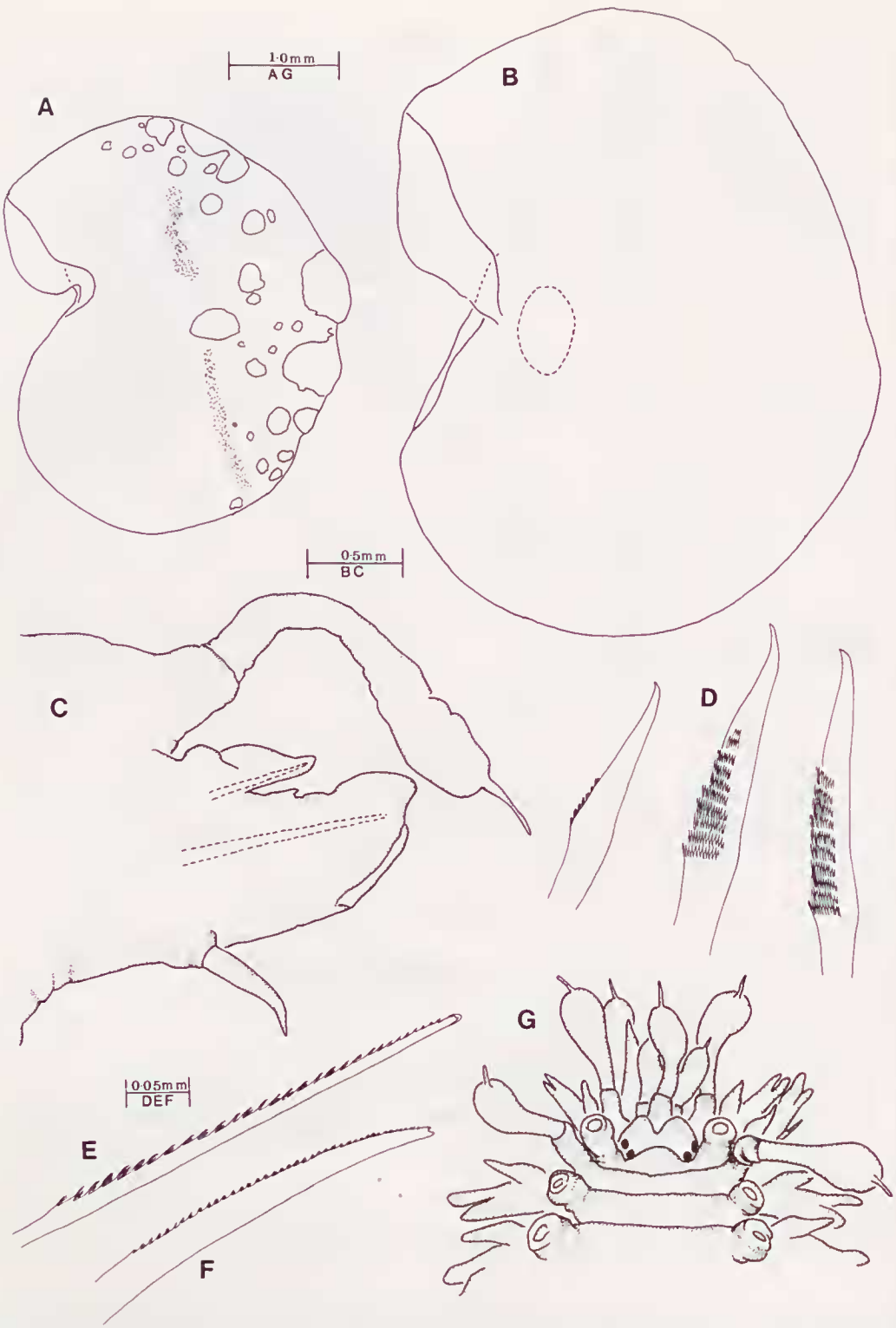

Fig. 10. *Gastrolepidia clavigera* NTM W4424: A, posterior elytron. MNHN A339: B, posterior elytron. AM 5144: C, cirrigerous parapodium; D, lower and middle neurosetae; E, upper neurosetae; F, notoseta. NTM W4424: G, anterior end, dorsal view.

Table 3. Variation of elytron attachment pattern on specimens of *Gastrolepidia clavigera* with 19 or more pairs of elytra

Specimen	*Length*	*Width*	*No. of segments*	*No. of pairs of elytra*	*Elytra attached on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 29, 32*
AM W5144 (A)	20mm	6.3mm	42	19	35, 36, 39, 40
AM W5144 (B)	16mm	5mm	47	21	35, 36, 38, 39, 41, 45
NTM W3952	18.6mm	6mm	53	26	35, 36, 38, 40, 42, 44, 46, 47, 48, 50, 51
NTM W4189	18mm	7mm	49	22+2odd ones	35, 36, 38, 39 (left), 41, 42, (right), 43, 45, 47
ZMA Siboga Expd. Palu Pasfi	25mm	7mm	41	19	35, 36, 38, 40
ZMA V. Pol 320	21mm	6.5mm	48	23	35, 36, 38, 39, 42, 44, 46, 48
MNHN # 1923	20mm	5mm	51	21	35, 38, 41, 44, 45, 48
NTM W4422	13mm	3.5mm	45	21	35, 36, 38, 40, 42, 44
NTM W4998	29mm	7.5mm	63	31	35, 36, 38, 40, 42, 44, 46, 48, 50, 51, 53, 55, 57, 59, 61 left side 35, 36, 38, 40, 42, 44, 46, 48, 50, 52, 53, 55, 57, 61, 63 right side.
NTM W4540	18mm	5.2mm	50	23	35, 36, 39, 41, 43, 45, 47, 49
NTM W5449	17mm	5mm	50	23	35, 36, 38, 40, 42, 45, 47, 49
AM W6014	17mm	6.5mm	40	19	35, 36, 38, 40
AM W6015	13.5mm	4mm	42	19	35, 36, 38, 40 left 39, 41 right
AM W6859	15mm	5mm	47	23	35, 36, 38, 39, 41, 42, 44, 45
NTM W4434	11mm	4mm	41	19	35, 36, 38, 40
NTM W4432	18mm	4mm	51	24	35, 36, 38, 40, 42, 44, 46, 49, 51
NTM W4532	18mm	5.4mm	42	21	35, 36, 38, 39, 41, 42

anterior margin with margin folded over surface (Figs 9C, 10A,B), and a small area of overlap on anterior side of the elytrophore scar, with margin overlapping (Fig. 10B); small indentation in the margin created by the folded pouch usually occupied by cirrophore of dorsal cirrus of preceding segment (Fig. 9C).

Prostomium bilobed, much wider than long, without cephalic peaks (Figs 8A, 9C, 10G). Two pairs of eyes, anterior pair large, lying dorsolaterally at widest point of prostomium, posterior pair slightly smaller (sometimes larger), lying close behind anterior pair and closer to midline. Palps, short, tapering gradually to a filiform tip. Ceratophore of median antenna large, truncated, inserted in anterior notch, with style smooth, basally cylindrical and expanding into large bulbous subterminal inflation, then abruptly tapering to filiform tip. Ceratophores of lateral antennae distinct, much shorter and smaller than median, inserted terminoventrally on distal ends of prostomium (Figs 8A,B, 10G), converging midventrally on underside of prostomium; styles similar to median antenna but usually shorter.

Tentacular (first) segment, not visible dorsally, tentaculophores lateral to prostomium, achaetous, with two pairs of dorsal and ventral tentacular cirri, smooth, similar in length and shape to median antenna. Facial tubercle well developed knob. Segment 2 with semilunar nuchal fold (Figs 8A, 9C, 10G), first pair of large elytrophores, subbiramous parapodia, and ventral buccal cirri longer than following ventral cirri.

Parapodia subbiramous (Figs 8F,G, 9E, 10C). Notopodium small, subconical with long flattened acicular lobe (Figs 8G, 9E, 10C). Neuropodium deeply cut dorsally and ventrally forming longer, thinner, sharply rounded presetal lobe and shorter, bluntly rounded postsetal lobe (Figs 8F,G, 9E, 10C). Dorsal cirri on segments without elytra, with cylindrical cirrophores and long, smooth styles, basally cylindrical, expanding into large subterminal inflation and abruptly tapered filiform tip (Figs 9E, 10C). Ventral cirri short, on small cirrophores, styles tapering gradually to a filiform tip. Nephridial papillae not visible on some specimens, usually beginning on segments 6-8, and continuing to end of body. Ventral lamellae large, conspicuous, on the bases of parapodia from segment 3 onwards (Fig. 8B, 9E).

Notosetae (Figs 8C, 9A, 10F) short to long, curved, with rows of serrations along outer edge, with notched tips. Neurosetae long, straight; upper group slender with numerous

rows of serrations and hooded, notched tips (Figs 8D, 9B, 10E); middle group stout, with fewer rows of serrations and slightly curved, unidentate tips (Figs 8E,H, 9D,F, 10D); and lower group similar with very few rows of serrations (Figs 8H, 9F, 10D).

Pygidium small, anus terminal, with pair of anal cirri resembling dorsal cirri.

Commensal on holothurians.

Distribution. Tropical Indo-West Pacific.

Remarks. The type material includes 3 syntypes, one complete, although fragmented, and two anterior ends. The complete syntype is the smallest, measuring 12mm in length, 3.5mm in width including parapodia, with 40 segments and 17 pairs of elytrophores (elytra all missing); no eyes are present, presumably they have faded during the specimens' long storage in alcohol. Styles of antennae, tentacular, dorsal and anal cirri all missing. However, the features of ventral lamellae, elytral arrangement, parapodia and setae are consistent with those described by Schmarda and subsequent authors.

The other two syntypes are incomplete. One an anterior fragment with prostomium (no eyes) and 14 segments, without elytra. The other specimen also has 14 segments, prostomium with posterior pair of eyes present and several elytra still attached. Both of these syntypes agree well with the description of the species I have given above.

In the original description Schmarda emphasised the unusual ventral lamellae (hence the generic name), and indicated that he thought they were similar in structure to the elytra, but provided little information on the rest of the animal. My examination of the ventral lamellae shows that the resemblance between these two structures is entirely superficial. The ventral lamellae are outgrowths of the body, whereas the elytra are highly modified dorsal cirri.

Grube (1876), briefly described another species, *Gastrolepidia amblyphyllus*, based on material from the Philippines, and in 1878 he provided another, more comprehensive description. Grube erected the new species because the ventral lamellae on the specimens he examined were not like elytra, as Schmarda had claimed in his description of *G. clavigera*. In both papers, Grube recognised that his new species might just be a variety of *G. clavigera*, as he was uncertain of Schmarda's interpretation of the ventral lamellae and had not seen the type material of *G. clavigera*.

Willey (1905) appears to have been the first author to synonymise *G. amblyphyllus* with *G. clavigera*, and this has been followed by all subsequent authors.

Willey (1905) and Potts (1910) indicate that the pattern of elytron attachment is invariable on all specimens examined. In their view the elytra were attached on 2, 4, 5, 7, etc. to 23, 26, 29, 32, 35, 36, 38, 39, and on alternate segments to the end of the body. Horst (1917) disagreed with this view, noting that on the specimens he examined there was some variation in attachment pattern after segment 36.

Subsequent descriptions (Augener 1926; Fauvel 1932, 1947; Day 1967; Uschakov 1982) added little additional information. Hartman (1954), was the first to record that the ventral lamellae begin on segment 3 and that the notosetae are capped by a delicate, hyaline hood; she did not mention the presence of similar hoods on the slender upper neurosetae.

Potts (1910) was the first to recognise that the association between *G. clavigera* and different holothurian hosts was the reason for the different color patterns observed on specimens of *G. clavigera*. Gibbs (1969, 1972) provides a list of the different holothurian hosts and suggests that the ventral lamellae might be an adaptation to life on a holothurian, allowing the worms to cling by suction to their hosts. Uschakov (1982) suggests that the ventral lamellae might have a reproductive function, and may only be present on large specimens. He records a small specimen of this species which did not have ventral lamellae. However, I consider this record as dubious, as specimens examined in my study ranged from 11mm to 29mm and all had well developed ventral lamellae beginning on segment 3. It is also interesting to note that the large specimen described by Uschakov (1982) was collected from *Pinna* overgrowth, whereas most of the records of this species indicate it is found on holothurians. Although many of the early records do not indicate hosts this is probably because the material was collected by dredge or trawl, in which case commensals are often separated from their hosts.

Incidentally, although no previous record emphasises that the ventral lamellae begin on

segment 3, this feature is one easy way to distinguish members of this genus from members of the genus *Paralepidonotus* Horst, 1915a, in which the very similar, though smaller ventral lamellae always begin on segment 4.

Genus *Bathynoe* Ditlevsen

Weberia Horst, 1915b:246 (type species *Weberia pustulata* Horst, 1915b, by monotypy; preoccupied in 1830 by *Weberia* Robineau-Desvoidy (Diptera)).

Bathynoe Ditlevsen, 1917:42 (replacement name; cf. Pettibone and Augener 1970:205. Gender: feminine).

Bathynoe tuberculata (Treadwell)
(Figs 11A-F, 12A-D)

Harmothoe tuberculata Treadwell, 1906: 1154

Arctonoe tuberculata - Hartman 1938:117, Fig. 37,e;f; 1956:260, 265; 1966:174; Uschakov, 1982:116.

Type material. HOLOTYPE - USNM 5205, Hawaii, vicinity of Niihau Island, commensal in actinostome of *Brisinga*, station 4177, on bottom of fine gray sand, 451-319 fms, coll. U.S. Fish Commission steamer *Albatross*.

Description. *Holotype*: Body short, flattened, tapering gradually anteriorly and posteriorly. Length 14.5mm, width including parapodia 4.6mm. Thirty five segments. From second segment onwards, dorsum with conspicuous digitiform tubercles medially, one on each segment (Fig. 11A). Entire body grey.

Elytra all missing, prominent elytrophores 18 pairs on segments 2, 4, 5, 7, alternate segments to 24, 26, 27, 29, 30, and 32.

Prostomium bilobed, wider than long, without cephalic peaks (Fig. 11A). Right side of prostomium damaged. Eyes absent. Two palps, both distorted and incomplete distally. Three antennae, all styles missing. Median ceratophore large, cylindrical, inserted in anterior notch. Lateral ceratophores larger than median ceratophore, inserted terminoventrally on the distal ends of the prostomium, converging in the midline on the underside of the prostomium (Fig. 11B).

Tentacular (first) segment, not visible dorsally, tentaculophores lateral to prostomium, achaetous, long, stout, with two pairs of tentacular cirri, only right ventral tentacular cirrus remaining, smooth, basally cylindrical, expanding into pronounced subterminal inflation and abruptly tapered to short filiform tip. Facial tubercle weakly developed. Segment 2 with large medial digitiform tubercle (Fig. 11A), first pair of elytrophores (elytra missing), subbiramous parapodia, and ventral buccal cirri (one on right side missing, Fig. 11B). Neuropodium of second segment with presetal lobe bluntly rounded, postsetal lobe shorter, straight. Base of postsetal lobe with long, digitiform lobe attached ventrally and deflected upwards, ending distally in two papillae-like projections.

Parapodia subbiramous (Figs 11C, 12A, C). Notopodium similar length to neuropodium, with long, digitiform acicular lobe,deflected upwards, slightly inflated distally. Neuropodium deeply cut dorsally, with longer, bluntly rounded presetal lobe (Fig. 12C), postsetal lobe shorter, bluntly rounded (almost straight), with digitiform lobe attached basally and deflected upwards (Figs 11C, 12A), outer edge and tip with densely packed papillae (= branchia, Treadwell, 1906). Cirrophores of dorsal cirri on segments without elytra, large, cylindrical, basally joined to conical, well-formed dorsal tubercles by fleshy ridge. Styles of dorsal cirri all missing (Fig. 12A). Ventral cirri absent from segment 3 onwards (Fig. 11D). Nephridial papillae not found.

Notosetae absent. Neurosetae, 5-10 on each parapodium, large, stout, straight, with subdistal swelling and several rows of very faint serrations between swelling and strongly curved unidentate tip (Figs 11E, F, 12B, D). Many tips of neurosetae broken or split.

Nephridial papillae not found.

Pygidium small, anus appears to be terminal, condition of specimen poor posteriorly, not possible to determine whether anal cirri were present.

Holotype ovigerous.

Commensal on asteroid of genus *Brisinga*.

Distribution. Known only from the type locality in the Hawaiian Islands, in 451-319 fathoms.

Remarks. The original description differs from the one given here in a few important respects. Treadwell (1906) states that there are 13 pairs of elytrophores, whereas I have

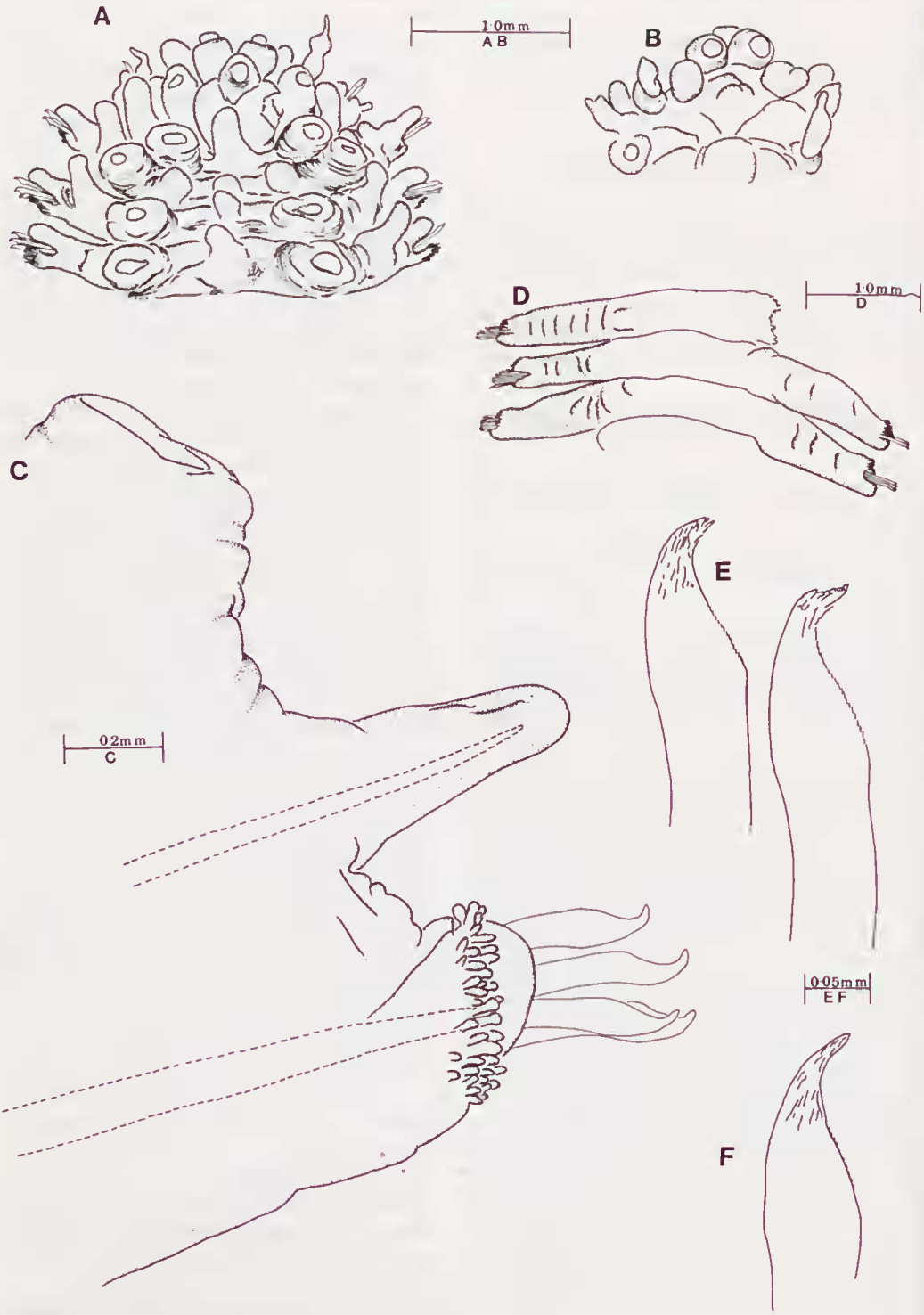

Fig. 11. *Bathynoe tuberculata*, holotype of *Harmothoe tuberculata* USNM 5205: **A**, anterior end, dorsal view; **B**, ventral view of anterior end; **C**, posterior view of elytragerous parapodium; **D**, ventral view of segments from middle of the body, note absence of ventral cirri; **E,F**, neurosetae, tips cracked and split.

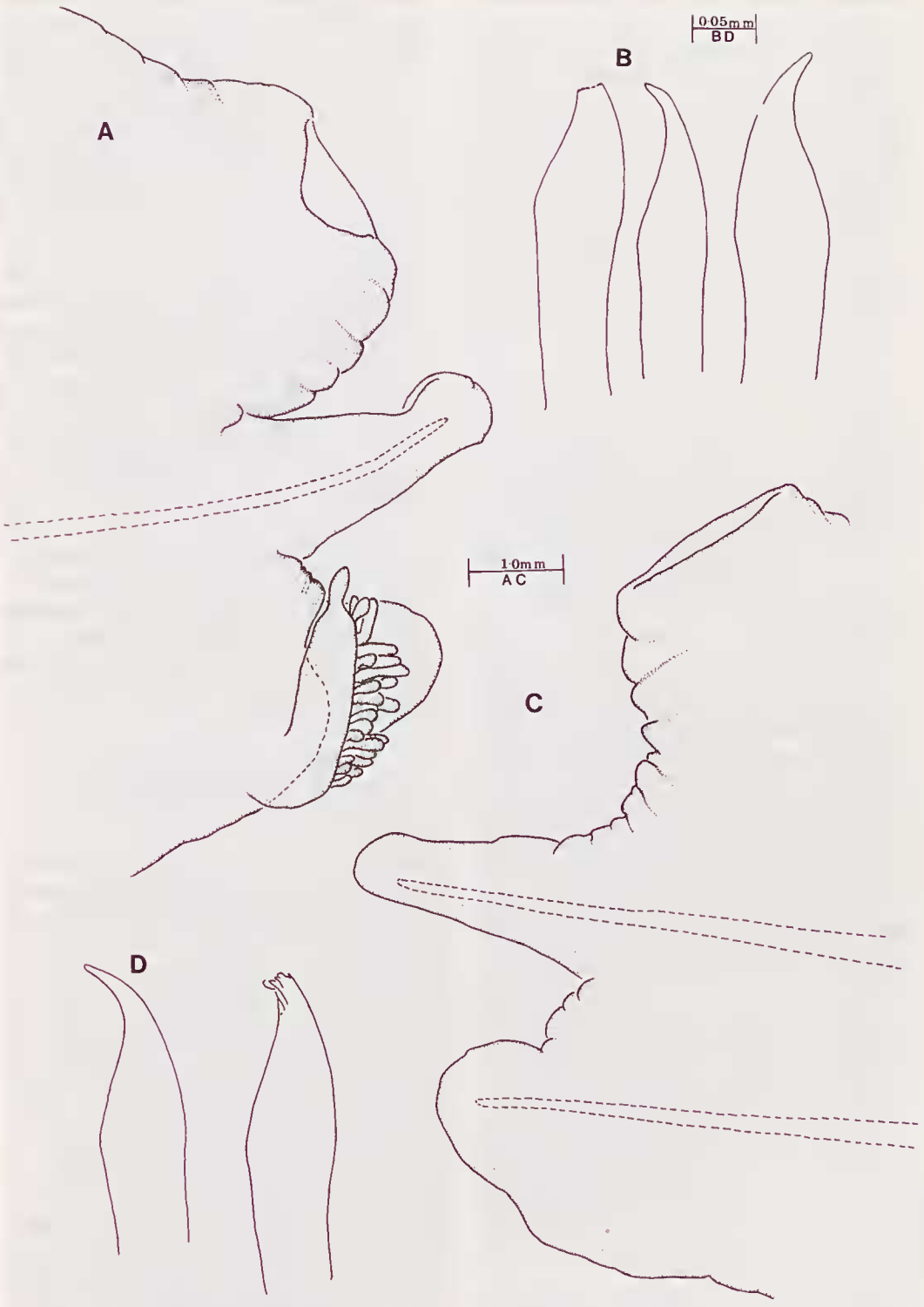

Fig. 12. *Bathynoe tuberculata* holotype: **A,** anterior view of cirrigerous parapodium; **B,** neurosetae; **C,** posterior view of elytragerous parapodium; **D,** neurosetae.

recorded 18. The poor condition of the specimen posteriorly, coupled with the close similarity in shape and position of cirrophores and elytrophores probably misled Treadwell. Indeed, I may have misinterpreted the structures on the last three segments of the body so that there may be more than 18 pairs of elytrophores. However, I believe there are dorsal tubercles present on these last few segments and therefore they are all cirrigerous.

Treadwell records the arrangement of elytrophores on the body as attached to segments 1, 2, 5, 7, etc., which I found to be incorrect in several respects.

According to Treadwell, segments 3 and 4, have dorsal cirrophores, which is incorrect as nowhere on the body, except for the last three segments, are elytragerous segments ever separated by more than one cirrigerous segment. The pattern of arrangement given by Treadwell implies that after the first few segments, the elytragerous and cirrigerous segments alternate until the end of the body, which is incorrect as there are adjacent elytrophores on segments 23 and 24, 26 and 27, 29 and 30.

The peculiar digitiform lobe on the postsetal side of each neuropodium has large papillae-like projections, which Treadwell (1906) called branchiae. I have found no evidence to suggest a respiratory function for these structures. They are clavate, and similar to the sensory papillae found on the cirrostyles of many polynoid scaleworms. This similarity of papillae, and the digitiform appearance of the lobe led me to suspect it may have been the ventral cirrus, and initially I thought the ventral cirri were present but attached distally. However a re-examination of the specimen, and in particular the second segment which has a pair of ventral buccal cirri, revealed the unusual lobe is also present on this segment, and therefore the ventral cirri are indeed missing from subsequent segments.

Treadwell referred the species to *Harmothoe* Kinberg, 1856, but the diagnosis of this genus notes that species have 15 pairs of elytra, whereas Treadwell recorded only 13 pairs for his new species. The absence of notosetae is another character which would preclude it from *Harmothoe*.

Hartman (1938) referred the species to *Arctonoe*, primarily because of its large, falcate neurosetae. Her description is short, and does not mention the number of pairs of elytra that the specimen might have had, although in the emended generic diagnosis of *Arctonoe*, Hartman states "Elytra 18 pairs or more...".

Bathynoe tuberculata cannot be included in *Arctonoe* because the arrangement of elytra on the body is very different from that seen in the other three species currently placed in that genus (see above). Each of these species share the same pattern of attachment up to segment 33, i.e. 2, 4, 5, 7, alternate segments to 23, 26, 28, 29 and 31.

The original description of *Weberia pustulata* by Horst (1915b) describes the same pattern of elytron arrangement as that seen on the holotype of *B. tuberculata*. In many respects the description of *Weberia pustulata* agrees with that of *B. tuberculata*: both have 18 pairs of elytra, the same attachment pattern, similar digitiform, papillate lobes on the posterior lobe of the neuropodia, and the large tubercles on the dorsum. The two species may eventually prove to be synonyms, but a decision cannot be made until the types of Horst's species have been examined.

Ruff (1989) has recently described another species of *Bathynoe* from the northeast Pacific and also refers *Harmothoe tuberculata* Treadwell to *Bathynoe* for the first time. His assignment is followed here.

Genus *Asterophilia* gen. nov.

Type species *Asterophilia carlae* sp. nov. Gender: feminine.

Diagnosis. Body flattened, fusiform, fragile, up to 35 segments. Body without pigment. Elytra 15 pairs, on prominent elytrophores, on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 29, and 32. Elytra large, soft, transparent. Prostomium bilobed, wider than long, without cephalic peaks. Two pairs of eyes on posterior half of prostomium, two palps, three antennae. Ceratophore of median antenna inserted in anterior notch, ceratophores of lateral antennae inserted terminoventrally on distal ends of prostomium, converging in midline on underside of prostomium. First or tentacular segment not visible dorsally; tentaculophores lateral to the prostomium, achaetous, with two pairs of dorsal and ventral tentacular cirri; facial tubercle absent. Second or buccal segment with small nuchal fold, first pair of elytra on prominent elytrophores, subbiramous parapodia, and ventral buccal cirri longer than following

ventral cirri. Parapodia subbiramous, notopodium small, on anterodorsal side of neuropodium, subconical with long, thin acicular lobe; neuropodium larger, deeply cut dorsally and ventrally, with longer presetal and shorter postsetal lobes, both bluntly rounded. Notosetae short to long, curved with rows of serrations and notched tips. Neurosetae long, upper ones slender with subterminal swelling, rows of serrations and hooded, notched tips; middle and lower ones much stouter, with subterminal swelling and fewer rows of serrations, middle ones with bi- or unidentate tips, lower ones with few rows of serrations and curved unidentate tips. Dorsal cirri present on segments without elytra, cirrophores large, cylindrical, styles smooth, cylindrical basally with subdistal inflation and filiform tip; dorsal tubercles absent. Ventral cirri short, tapered. Nephridial papillae present from about segment 6 onward. Anus terminal with anal cirri?

Commensal on asteroids.

Etymology. The generic name refers to the relationship between the polynoid and its asteroid host, from the greek *aster* (star) and *phile* (love).

Remarks. Reference to Fauchald (1977) demonstrates that there are a large number of polynoid scaleworm genera with 15 pairs of elytra. Many of them are monotypic. The creation of yet another monotypic genus of polynoid scaleworm with 15 pairs of elytra attached on segments 2, 4, 5, 7, alternate segments to 23, 26, 29 and 32, i.e. the most common arrangement, may not be universally accepted, but it is not presently possible to satisfactorily reconcile this species with any of the existing genera. *Asterophilia carlae* sp. nov. has prostomial features which ally it closely with *Gastrolepidia clavigera*, its parapodia and setae are also very similar morphologically to those of *G.clavigera*, as evidenced by Horst's (1917) incorrect identificaton of the two Siboga specimens as *G. clavigera*. These similarities with *G. clavigera* make *A. carlae* incompatible with most of the existing genera (mainly Harmothoinae) which have 15 pairs of elytra and the same attachment pattern. The only other genus which has the same number of pairs of elytra, the same attachment pattern, and also has terminoventral insertion of the lateral antennae on the prostomium is *Paralepidonotus* Horst, 1915a, and as *A. carlae* does not have ventral lamellae it cannot be aligned with this genus.

The similarities with *G. clavigera* also include *Asterophilia* within the new subfamily Aretonoinae wherein it can be distinguished from most of the genera by its relatively short body and elytron attachment pattern. Some species of *Adyte*, *Subadyte*, and *Paradyte* could be confused with *Asterophilia* because they have 15 or 16 pairs of elytra and the same attachment pattern (for the first 15 pairs). However, all these species have well-developed semilunar pockets on all neurosetae (see remarks under *A. carlae* below).

Asterophilia carlae sp.nov.
(Figs 13A-G, 14A-G, Plate 1C-F)

Type material. HOLOTYPE - NTM W5265, Fiji, Mana Western, from oral side of *Linckia laevigater*, 5m, July, 1985, coll.?.

Additional material. ZMA V.Pol.319 Gier No. 3, Exp. No. 26, Wit oksels des armen van en Astrides, 25.x.1907, 2 specimens.

Description. *Holotype*: Body flattened, fusiform, fragile, flesh-coloured. Length 11mm, width including parapodia 4mm. 35 segments.

Elytra 15 pairs on segments 2, 4, 5, 7, alternate segments to 23, 26, 29 and 32. Elytra large, soft, overlapping medially and posteriorly, covering dorsum. Elytra without tubercles or fringe of papillae, with fold on anterior edge near elytrophore scar (Figs 13D, 14B), posterior margin sometimes slightly folded or convoluted, posterior half of elytra with three, rarely two or four, raised domes, not easily visible on preserved specimen. Most of elytron transparent but domed areas with creamy, white pigmentation (Plate 1D-F).

Prostomium bilobed, wider than long, without cephalic peaks (Figs 13A, 14A). Two pairs of eyes, anterior pair of moderate size, lying dorsolaterally at widest part of prostomium, posterior pair slightly larger, close behind anterior pair and closer to midline. Palps, short, stout with abruptly tapered tips. Median antenna with moderate sized ceratophore inserted in anterior notch, with style smooth, basally cylindrical, expanding into very large subterminal inflation and abruptly tapered short, filiform tip; lateral antennae with distinct ceratophores, shorter and thinner than median ceratophore, inserted termi-

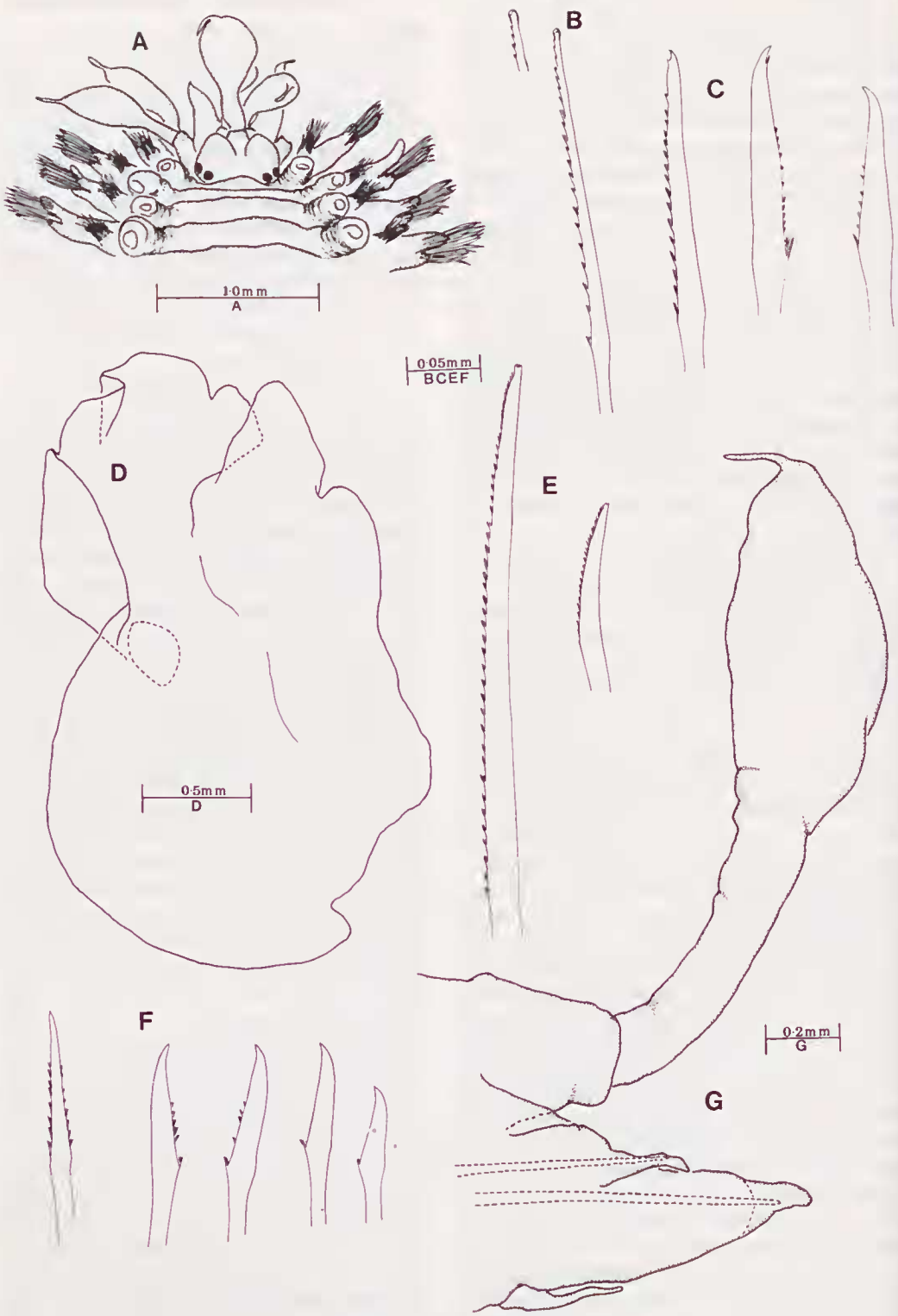

Fig. 13. *Asterophilia carlae* holotype: **A**, anterior end, dorsal view; **B**, upper neuroseta; **C**, middle neurosetae; **D**, elytron; **E**, notosetae; **F**, middle and lower neurosetae; **G**, cirrigerous parapodium, posterior view.

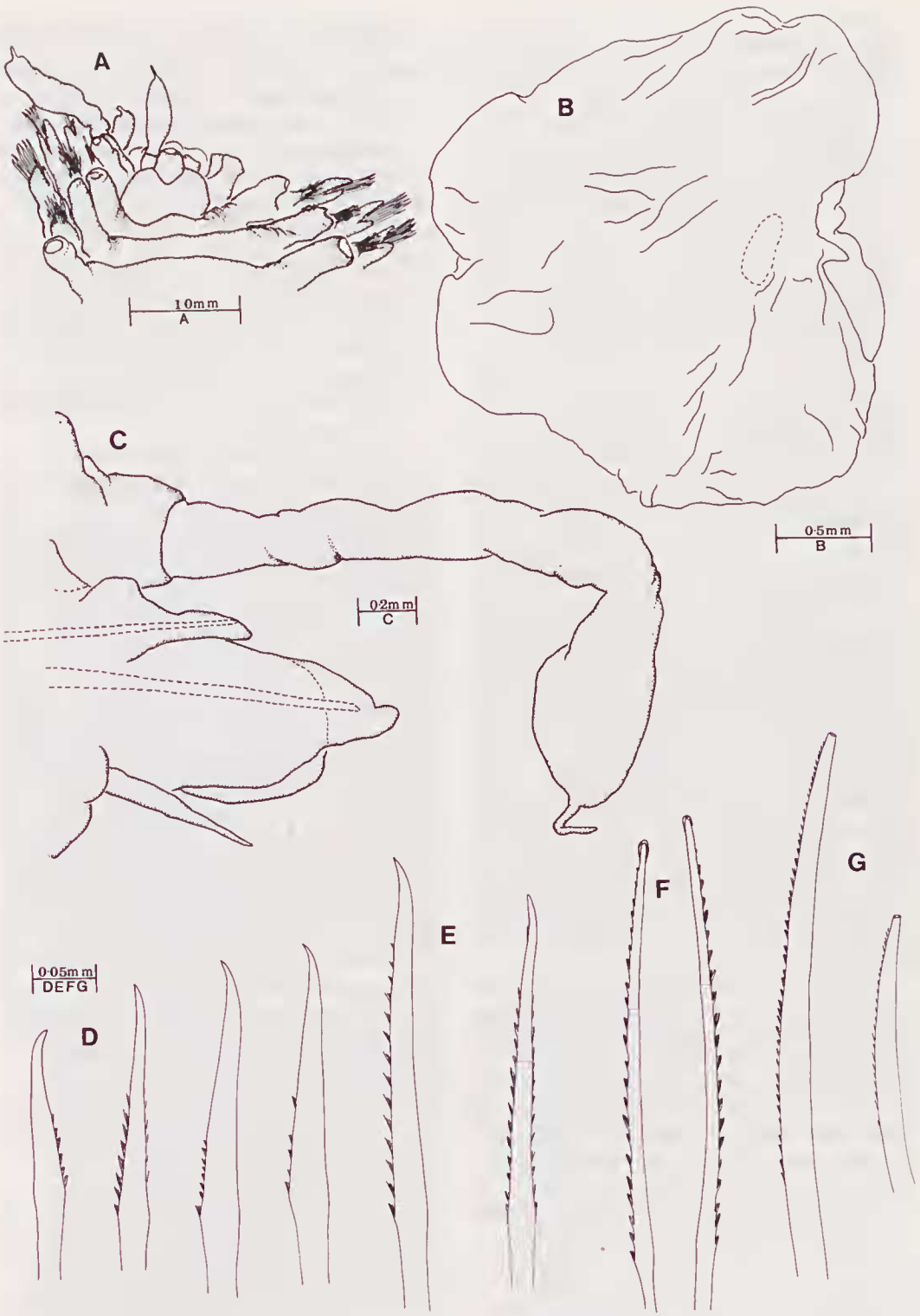

Fig. 14. *Asterophilia carlae*, two specimens from Gaspar Strait, **A**, larger specimen, **B-G**, smaller specimen: **A**, anterior end, dorsal view; **B**, elytron; **C**, anterior view of cirrigerous parapodium; **D**, lower neurosetae; **E**, middle neurosetae; **F**, upper neurosetae; **G**, notosetae.

noventrally on prostomium (Figs 13A, 14A), converging midventrally on the underside of the prostomium, styles similar in shape to median antenna but much shorter.

Tentacular segment, not visible dorsally, tentaculophores of moderate length lateral to prostomium, achaetous, with two pairs of dorsal and ventral tentacular cirri; styles smooth, of similar length and form to median antenna. Facial tubercle weakly developed. Segment 2 with semilunar nuchal fold, first pair of large elytrophores, subbiramous parapodia, and ventral buccal cirri with styles of similar length and shape to lateral antennae.

Parapodia subbiramous (Figs 13G, 14C). Notopodium small, subconical, with long, digitiform acicular lobe, on anterodorsal side of neuropodium. Neuropodium much larger (Figs 13G, 14C) with longer subtriangular presetal acicular lobe with a sharply rounded tip, and shorter, bluntly rounded postsetal lobe.

Notosetae (Figs 13E, 14G) short to long, curved, with rows of serrations along outer edge and notched tips (Figs 13E, 14G). Upper neurosetae long, slender with a subdistal swelling, many rows of serrations and hooded, notched tips (Figs 13B, 14F); middle neurosetae stouter, with pronounced subdistal swelling, fewer rows of serrations, most basal largest, resembling semilunar pocket seen on specimens of *Adyte*, and bi- or unidentate tips (Figs 13C, F, 14E); lower neurosetae, stout, shorter, with subdistal swelling, few rows of serrations and unidentate, slightly curved tips (Figs 13F, 14D); neurosetae in middle of bundle grading from upper to lower types.

Dorsal cirri on segments without elytra, cirrophores large cylindrical, with styles large, basally cylindrical, expanding into large subterminal inflation and abruptly tapered filiform tip (Figs 13G, 14C). Ventral cirri short, gradually tapering to filiform tip. Nephridial papillae well-developed, conspicuous, beginning segment 6 and continuing to end of body.

Pygidium small, terminal, with pair of anal cirri similar to dorsal cirri.

Holotype commensal on large blue starfish *Linckia laevigater* (Plate 1C).

Description of two specimens, from Gaspar Strait on asteroid: Both incomplete, one with 27 segments, length 19mm, width including parapodia 4.8mm; the other with 20 segments, length 10mm, and width including parapodia 4.4mm. Prostomium of larger specimen (Fig. 14A) lacking eyes, only left antenna and ventral tentacular cirrus remaining, both palps missing, otherwise similar to holotype. Prostomium of smaller specimen with two pairs of eyes and similar to holotype except for pair of long, slender palps considerably longer than those of holotype.

Parapodia and setae of specimens also similar to those of holotype (Fig. 14C-G). Larger specimen lacking elytra, a few remaining on smaller specimen (Fig. 14B); pattern of attachment on incomplete specimens identical to holotype.

Specimens recorded from the arms of asteroid by Horst (1917).

Distribution. Known only from the Type locality, Mana Western, Fiji and the Gaspar Strait, Indonesia.

Etymology. The species is named after my daughter Carla in honour of her 7th birthday.

Remarks. *Asterophilia carlae* when first observed on the host, the large blue seastar *Linckia laevigater* (Plate 1C) appears conspicuous (Plate 1D-F), seemingly incongruous, since in general, the match of colour pattern and shape between commensal and host is by necessity excellent - testament to the eyesight of predators. It appears to me that the polynoid is in fact beautifully mimicking the tube feet of its starfish host. Often the seastar has only a portion of each ambulacral groove open and this groove, through which the tube feet protude, is ellipitical in outline. *Asterophilia carlae* mimics such an opening in an ambulacral groove perfectly because the large swellings on the ends of its antennae, tentacular and dorsal cirri, and the three raised mounds on the posterior edge of each elytron resemble closely the tube feet of the seastar (Plate 1D-F).

The two specimens of *A. carlae* collected by the Siboga expedition (Horst 1917) were also collected from a starfish, however the species of host was not recorded.

Linckia laevigater (Linnaeus, 1758) is widely distributed throughout the Indo-Pacific region (Clark and Rowe 1971) where it can be found in large numbers on coral reefs. Given the wide distribution and large numbers of this host it is surprising that *A. carlae* seems to be rare. Dr Paddy Ryan (pers.comm.) has informed me that although *L. laevigater* is common in nearshore waters of Fiji, he has

seen very few speeimens of *A. carlae*. During a recent expedition to Ashmore and Cartier reefs by staff of the Northern Territory Museum, a comprehensive examination of several hundred speeimens of *Linckia laevigater* failed to find a single polynoid eommensal.

I have not deseribed the basal row of spines on the neurosetae of *A. carlae* as semilunar poekets (Fig. 13B, C, F). They are not as well-developed as those seen on speeies of *Adyte* and related genera (Pettibone 1969a; Hanley 1984), and I am not eonvineed they are homologous, although given the placement of *Asterophilia* and *Adyte* in the same subfamily on other morphologieal grounds, they may well be.

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